The Electrical Industry's Weekly Magazine, September 1, 1958
Price One Dollar

Electrical World

a quarterly special report

Centralized Meter Testing at PS of New Hampshire

...p 99

starts on p 73

- Production line testing offers considerable savings to PS of New Hampshire
- Philadelphia Electric finds bent tube extensions stop cracking of boiler drums
- Skin divers with cameras check submarine cables for Cape & Vineyard Electric

Features:

Construction p 108
Operation and Testing p 118
Maintenance and Repair p 124

ALLIS-CHALMERS ANNOUNCES

POWER FACTOR CAPACITORS

25 and 50 kvar, 2400 thru 7960-volt capacitors

. . . available for immediate shipment

- meet all the national standards
- a *complete* capacitor package (capacitors, racks, voltage and current controls, other accessories)
- Five years of research, design and development bring you the best in capacitor engineering!

Where to get more capacitor facts fast!

Call, write or wire . . .

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Electrical World

Vol. 152, No. 13 SEPTEMBER 28, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Efforts Expand on School Heating Promotion

Utilities refine their approach and add new tools to sell all-electric concept to school boards and architects.....p 44

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Rewinding Transformers May Be Economical

John O. Fenwick, Daley Electric Co

Cost evaluation indicates it is feasible to rewind many distribution transformers that are as much as 33 years old..p 54

GENERATION

Why Italy Needs Nuclear Power

Dr. Bruno Bianchi, Society Elettrònucleare Nazionale

Here are reasons why Italy appears to be the most decisive of the Common-Market countries in charting atomic research.p 52

SUBSTATIONS

Substation Changes Reduce Costs

John L. Nolte, Union Electric Co

Motor-operated disconnects on 34-kv side help streamline substation operations, uprate capacities.....p 49

Special Report

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Electric Utility Methods

New techniques and equipment are featured in this 68-page special quarterly report edited expressly for utility men in construction, operation, maintenance, safety, stores and shops

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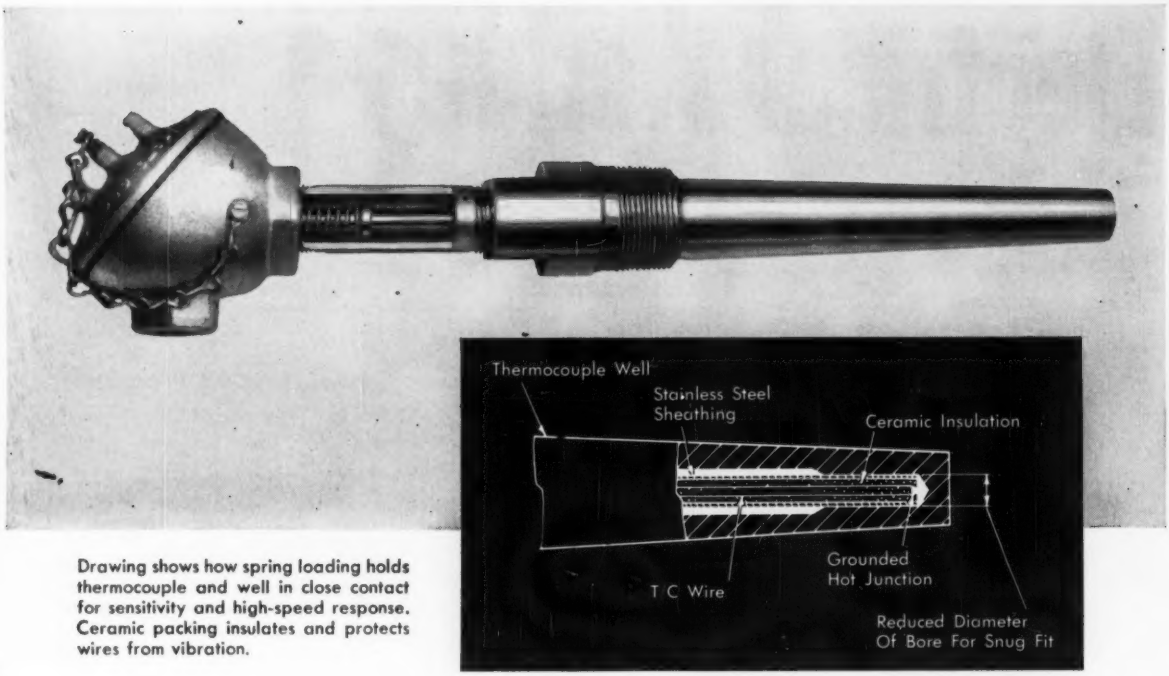

Drawing shows how spring loading holds thermocouple and well in close contact for sensitivity and high-speed response. Ceramic packing insulates and protects wires from vibration.

measure temperatures of high-pressure, high-velocity steam with

New spring-loaded thermocouple

- **High sensitivity**
- **Fast response**
- **Rugged well design**
- **Field-proved**

Design of this rugged, fast-acting thermocouple has been improved to combine high sensitivity with superior mechanical strength.

The thermocouple element is protected from vibration by an inert magnesium oxide packing which holds wire in place inside a stainless steel tube. Two features assure high-speed response to temperature changes: (1) the bore in the well is large enough to permit easy removal of the thermocouple element, and has a smaller diameter near the hot junction to provide a tight fit for highest sensitivity; and (2) spring loading provides positive, metal-to-metal contact between thermocouple and well, for highest rate of heat transfer to the measuring section.

Available in three styles: single-tapered and threaded, and single-tapered for welding in a drilled hole, or double-tapered for welding in a drilled and reamed tapered hole. For working pressures to 5000 psig, temperatures to 1250° F., velocities to 225 fps.

Your nearby Honeywell field engineer can give you complete details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

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LETTERS

Progress Report on Perforations vs "Perfect Bind"

To the Reader:

Responses are still coming in from readers commenting on our "perfect bind" experimental issue of August 24. As of this week, here is the score:

Favor "perfect bind"	52%
Favor perforations	45%
Either is okay	3%

Comments, for the most part, have been brief and vigorous. We have had many sample pages of the "perfect bind" which did not tear smoothly, but we believe this can be overcome with a little practice. One reader reported that his copy came apart in the humid Philadelphia weather—we're following up on that one.

The test run has raised other questions involving availability of equipment and printing schedules which are still under study.

The Editor

The Case of the Missing Table

To the Editor:

In your issue of August 3, you had an article on power plant enclosures, pages 46-48.

There seems to be some error in this article. In the next to the last paragraph on page 48 you refer to table 3. I cannot find it. Please advise.

R. A. Langworthy
37 Highland Avenue
Chatham, N. J.

We combined the information originally intended for table 3 with that displayed in table 1—but failed to delete the reference.

Charts Were Interchanged

To the Editor:

I would like to call your attention to an error July 6, 1959 issue in an article by H. G. Saddock and me, entitled "Capacitor Ends Flicker From Residential Welder." The two voltage charts showing the voltage conditions before and after the capacitor have been interchanged, giving the erroneous impression that the flicker increased after the capacitor installation. The purpose of the series capacitor, of course, was to reduce the flicker.

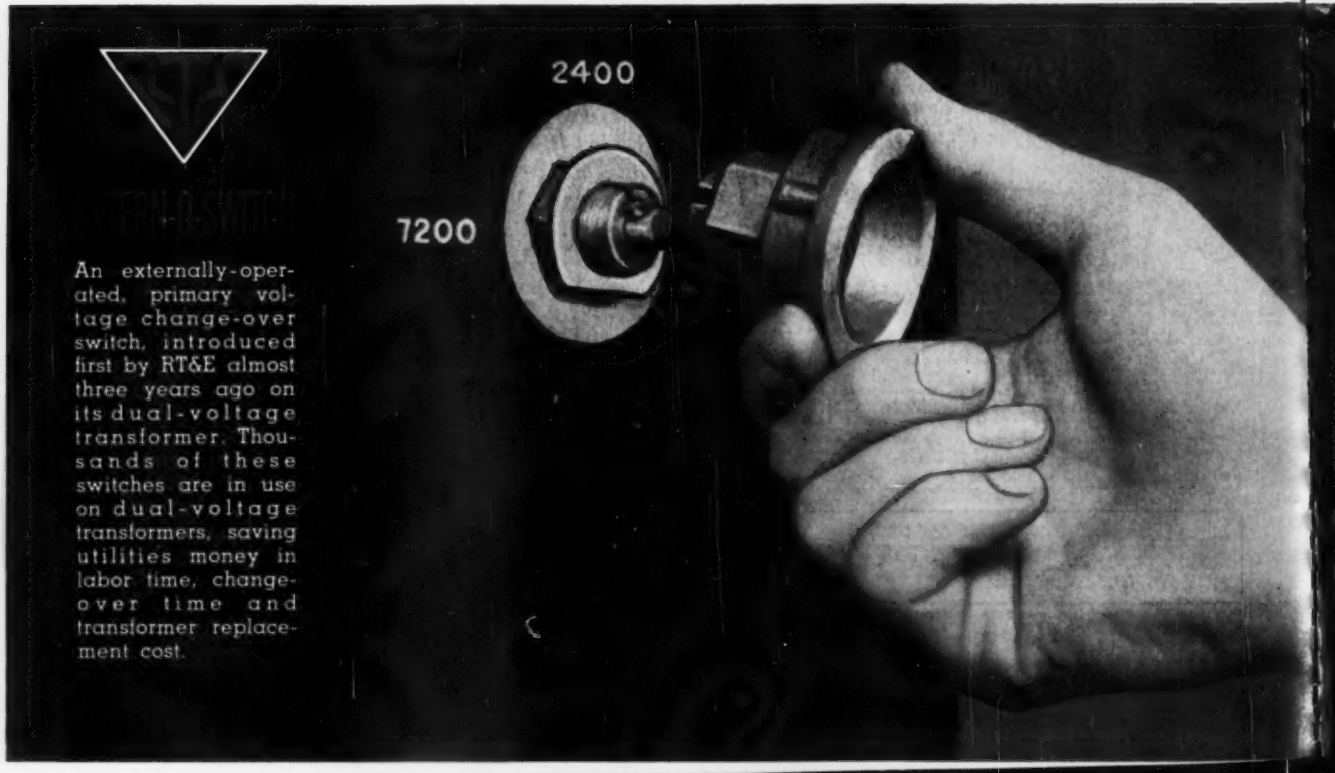
J. A. Sainz
Capacitor Department
General Electric Company
Hudson Falls, N. Y.

EXTERN-O-FUSE

An externally-changeable, bayonet type high-voltage fuse now available on the RT&E Terra-Tran. This new fuse now makes replacement of blown fuses a relatively simple operation . . . they are removed and replaced without entering the transformer.

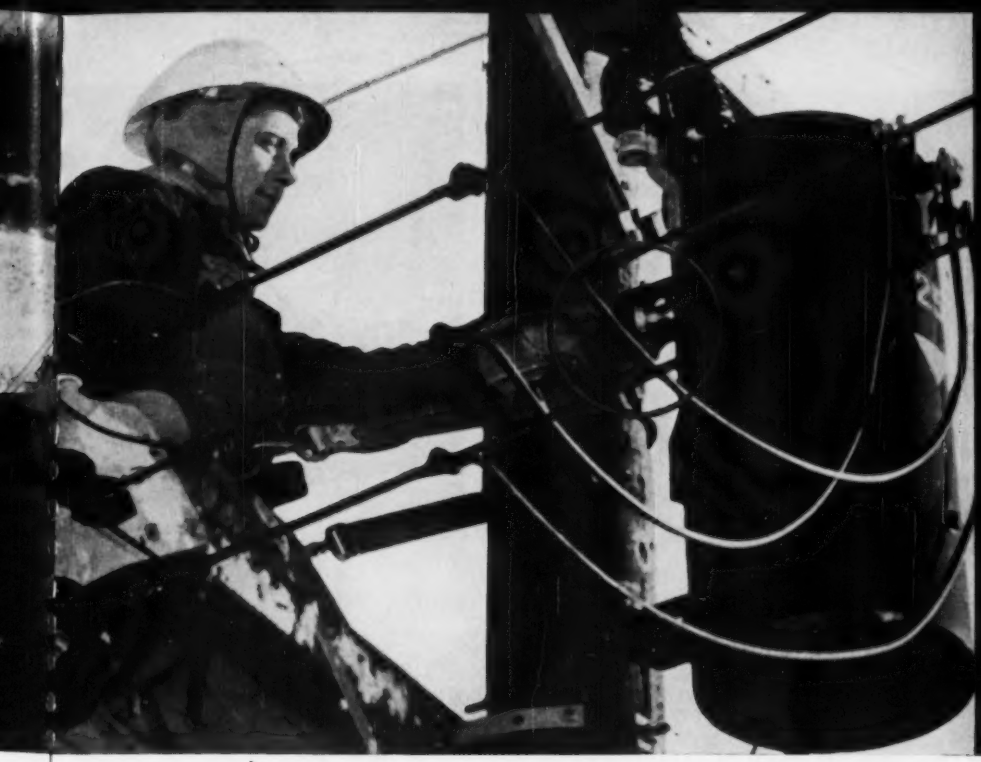
INTRODUCING THE RT&E EXTERN-O-SYSTEM

These "EXTERN-O" devices developed exclusively by RT&E are proven and in use today as they point to the completely sealed transformer of the immediate future. You can profit from their use today, their ultimate application tomorrow.



TERN-O-SWITCH

An externally-operated, primary voltage change-over switch, introduced first by RT&E almost three years ago on its dual-voltage transformer. Thousands of these switches are in use on dual-voltage transformers, saving utilities money in labor time, change-over time and transformer replacement cost.

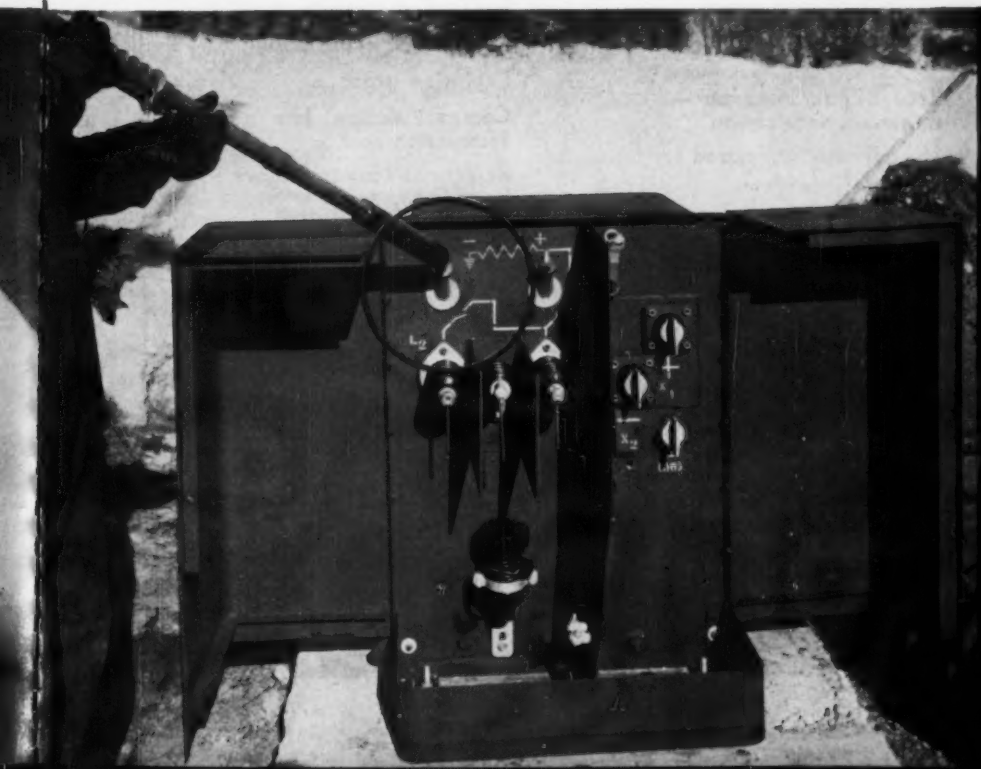


A safe, proven, externally operated tap changer made only by RT&E. With it, there is no handhole cover to remove, less danger on pole during service, no tap setting confusion, no oil contamination and fewer exposed parts to corrode.

THE WAY TO A COMPLETELY SEALED TRANSFORMER

Reduce operating and maintenance costs, increase personnel safety. Eliminate entering the tank, prevent oil contamination, extend life of the transformer.

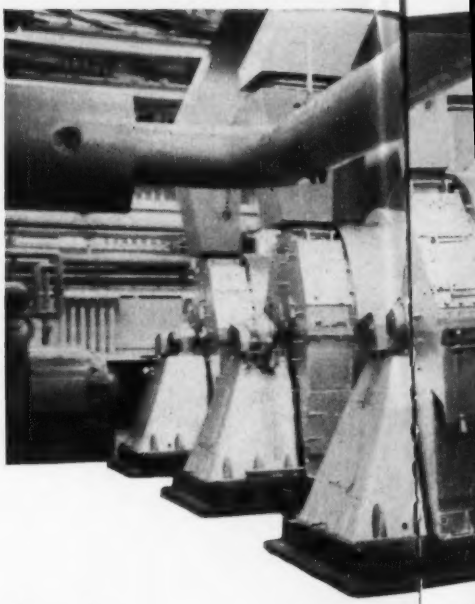
RT&E CORPORATION • Waukesha, Wisconsin • Portland, Oregon



An externally-operable bayonet type disconnect switch now available on the RT&E Terra-Tran. With it, line sectionalizing for quick and easy isolating of faulted transformers or faulted cable is easily carried out.

cc

With RILEY PULVERIZERS Installed In Your Plant

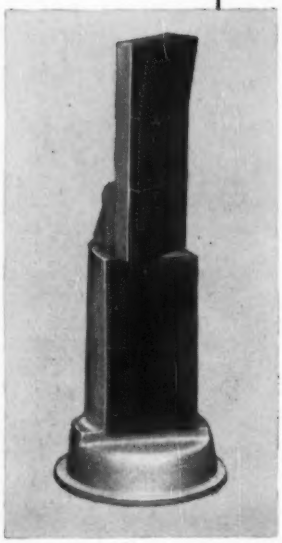


Silence is Golden

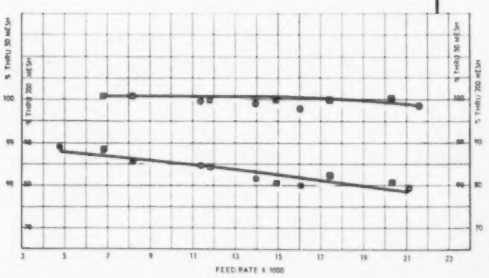
. . . Because Riley Pulverizers Operate Quietly

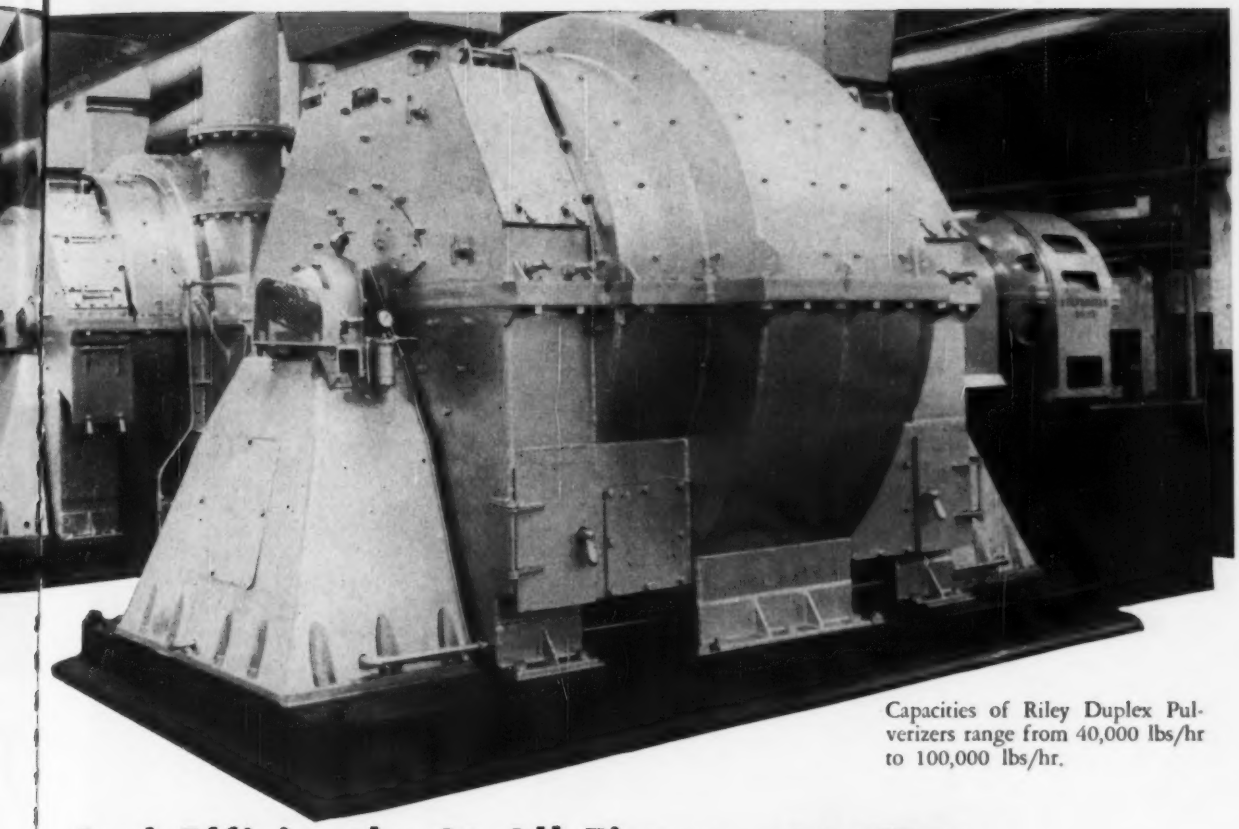
Other Advantages of Riley Pulverizers

- Wide fuel type range
- No loss of capacity with wet coal
- Ease of maintenance — minimum lubrication
- No adjustment needed to sustain fineness
- High primary air temperatures are used
- Sustained high fineness with tungsten carbide faced pulverizing elements
- Ease of automatic regulation
- Low power consumption
- Explosion proof
- Compact design, low foundation cost
- Rejections easy to remove
- Pressurized operation
- Wide capacity selection from 3,000 lbs/hr to 100,000 lbs/hr



At left is a typical pulverizing element faced with high grade erosion resistant tungsten carbide. At right are the results of fineness test conducted on a duplex type pulverizer. Test #1 ○ before elements were replaced; test #2 □ after new elements were installed. Results show no appreciable drop in fineness and capacity in either case.

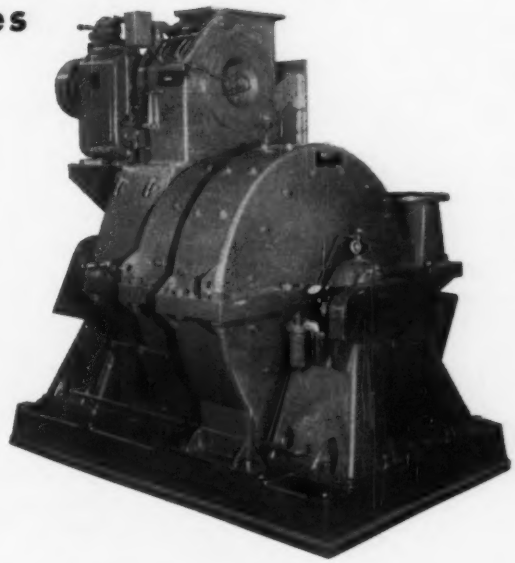




Capacities of Riley Duplex Pulverizers range from 40,000 lbs/hr to 100,000 lbs/hr.

And Efficiently At All Times

The Riley Pulverizer reduces coal to high fineness by attrition with no metal-to-metal contact . . . coal particles are reduced in size by impact against rotating and stationary pulverizing elements . . . *the action is soundless* . . . perfect balancing of all rotating elements assures smooth vibration-free operation. Visit one of the hundreds of plants using Riley Pulverizers . . . you'll be amazed at how comfortably you can hold a normal conversation in the pulverizer room.



Single Riley Pulverizer capacities range from 3,000 lbs/hr to 30,000 lbs/hr. Unit is equipped with Riley metering coal feeder with magnetic separator.

You'll find all the many operating and design characteristics of Riley Pulverizers fully explained in a new Pulverizer Catalog. For your own copy ask a Riley Representative in one of these cities . . . Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Syracuse, Worcester.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

RILEY STOKER CORPORATION, WORCESTER, MASS.

With Metal-Clad Switchgear...

Federal Pacific's new Protected Work-Aisle

provides safe and comfortable conditions in any kind of weather!

Note extensive work area in Federal Pacific's new Protected Work-Aisle at Pennsylvania Power & Light Company's Walnut Sub-Station, Harrisburg, Pennsylvania.

You can shield both your maintenance crews and your metal-clad switchgear from the assaults of bad weather with Federal Pacific's new walk-in Protected Work-Aisle. They're heated, they're weatherproof, they provide plenty of elbow room, and they're safe. Their unobtrusive and good-looking lines assure a welcome reception in any location. Look into the advantages of the Protected Work-Aisle now, while the weather is good. Write Federal Pacific Electric Company, General Offices: Department 338, Newark 1, New Jersey.

FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment

The Electrical Week

LATE NEWS ▶ **Two shipping firms are formed by Tampa Electric** along with Peabody Coal and Virginia-Carolinas Chemical. New firms will help cut coal shipping costs at Tampa's Gannon Plant and carry phosphate products from Tampa to principal ports elsewhere.

Industrial Relations Roundtable Conference highlights . . . "After 30 years of indecision, EEI is hoping for an industry-wide public relations program, Kimball I. Jack, vp of Washington Water Power, told the conference. He said the electric industry is "losing ground." Industry leaders, he continued, "have given us not more than 10 years to stop the collectivist trend, or we may never recover." Charles E. Parker, president of Central Surveys, Inc, revealed that nationally 36% of all utility employees are dissatisfied with their chances for promotion, only 12% with their equipment.

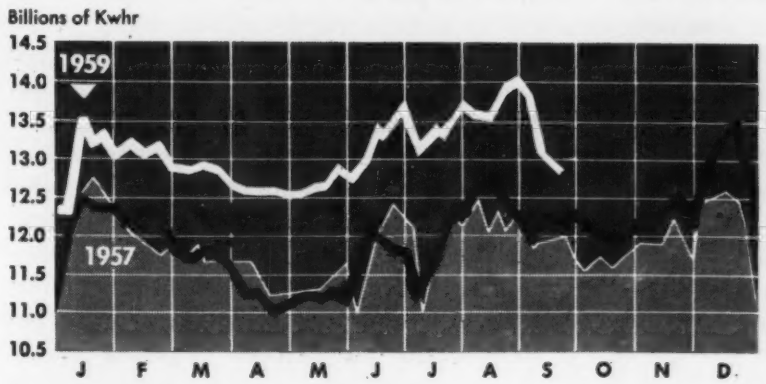
To give its Bergen station operators more precise operating guides Public Service E&G last week bought a unique new transistorised digital computer from Leeds and Northrup. Believed first applied to gas and coal fired units, it is capable of performing control duties.

Union Electric grants 5% wage hike to workers in locals not represented in bargaining last month when 5% increase went to IBEW locals . . . Northwest Public Power Assn reports its more than 100 systems granted wage boosts averaging 4.1% during past year.

Management changes . . . Frank McLaughlin becomes board chairman at Puget Sound P&L; J. H. Clawson is new president . . . G. L. Capwell elected president of Empressa Electrica del Ecuador, A&F subsidiary.

Obituary . . . George N. Hawley, Southern California Edison vp, died in Glendale, Calif., Sept. 8.

WEEKLY POWER OUTPUT—UP 4.4% (Week ending Sept. 19), Kwhr 12,779,000,000



Per Cent Change From Previous Year

	Sept. 5	Sept. 12	Sept. 19
Total U. S.	+14.4	+ 7.0	+ 4.4
New Eng.	+18.2	+ 1.9	+ 4.7
Mid. Atlan.	+25.1	+11.1	+ 2.7
Cent. Ind.	+10.9	+ 4.4	+ 2.3
West Cent.	+13.7	+ 5.9	+ 4.8
Southeast	+13.5	+ 6.6	+ 3.9
South Cent.	+13.8	+10.4	+ 5.6
Rocky Mount.	+ 6.0	+ 2.6	+ 6.3
Pacific			
NW	+ 7.1	+ 7.7	+11.4
SW	+13.5	+10.0	+ 7.6

Seasonally Adjusted Index 245.7

Week Ago 255.3 Year Ago 234.8

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Electric school heating promotion efforts begin to broaden,** as utilities see a chance to acquaint a new generation with electricity's benefits, while giving school boards more value for tax dollars **(p 44)** . . . Using a milder approach this year, Clyde Ellis, NRECA head, is telling regional co-op meetings to set up "model" systems **(p 46)** . . . Early EHV tests show no corona loss up to 600 kv **(p 46)** . . . Internal Revenue Service issues somewhat stricter revision on tax-exempt ad contributions. Power companies, meanwhile, still disagree with single-ad interpretation **(p 47).**

ENGINEERING ▶ **Motor-operated disconnects on the 34-kv side** help streamline Union Electric Co's substation operations. It also helps to uprate capacities, thus cutting costs **(p 49)** . . . Bruno Bianchi tells why Italy must resort to nuclear power **(p 52)** . . . Transformers, some as old as 33 years, can be rewound for savings **(p 54)** . . . A voltage-suppressing resistor, a carbon block in porcelain weather housing, eliminates switching surges **(p 70).**

SPECIAL REPORT ELECTRIC UTILITY METHODS ▶ **Highlights of this 68-page quarterly report,** with its own table of contents on page 73, include feature articles on: Tube extensions to stop boiler drum cracking **(p 104)** . . . Economical meter testing **(p 99)**

Politics and Public Power

A LOOK AT OUR RESOURCES

Something rare is scheduled for Oct. 12-16 in Washington, D. C.—a five-day Congressional hearing on power and fuel resources which is billed as "non-controversial."

The hearings will be held by the Joint Economic Committee's subcommittee on automation and energy resources, headed by Rep Wright Patman (D-Tex.). Other members: Sens Joseph O'Mahoney (D-Wyo.), John Kennedy (D-Mass.), John Butler (R-Md.) and Reps Henry Reuss (D-Wis.), Clarence Kilburn (R-N.Y.), William Widnall (R-N.J.).

Instead of writing a critical report on how the nation's resources have been and should be handled, the group plans to compose a "think piece"—the sort of report which may serve as a general background document for the coming years.

The purpose of the hearing is to review the "anticipated needs for and adequacy of U. S. energy resources . . . the impact of technology on the production and efficient use of the energies required for sustaining economic growth . . . the over-all prospective requirements and demand for energy from conventional sources . . . the outlook for commercial production from other sources such as nuclear and solar power."

This will be the first time this group has looked into the nation's energy resources in its five-year life. Most of the time it's been concerned with monetary and fiscal problems.

Committee aide William Moore, who probably will conduct the hearings, says an attempt will be made to stay away from major controversies, such as the public-vs-private power fight. Main purpose of the hearings will be to determine the direction of growth in the

. . . Inspection of submarine cable by skin divers (p 102) . . . And new equipment (p 75).

PROCUREMENT & PRODUCTS ▶ **Residual oil prices could go up with a "time-out" in steel strike** . . . Electrical manufacturers and the aluminum industry are already feeling the strike's effects as it enters 12th week (p 64).

MANUFACTURERS ▶ **GE redesigns its large power transformer line,** aiming for price stability to combat inflation . . . Roebling movies on short circuit tests to be shown to utilities soon (p 56) . . . Tobe Deutschmann ends production of capacitors Sept. 8 at its Norwood, Mass, plant (p 58).

MANAGEMENT ▶ **How can utilities trim their financing costs?** With bond yields hovering near a 30-year peak, utility financial managers must search diligently for ways to hold them down as much as possible. This week's Management Newsletter covers four possible methods for doing this: shortening maturities, waiving redemption premium, using convertibles, and switching to common stock (p 143).

SELLING ▶ **Kansas greenhouse man turns to electric heat to nurture plants** . . . Weigand Co schedules electric heating workshops (p 147).

nation's fuel and power industries, and what problems, if any, such growth may cause.

Moore cited an example of one problem the group is expected to study: the economic impact of one fuel on another—natural gas vs coal; imported vs domestic fuel oil; nuclear vs conventional fuels; etc.

Another area will be the need and availability of power in the U. S. "We aren't concerned with who supplies the power," he added, "We're only concerned with its long-range need and availability."

The hearings were first announced June 16 after subcommittee members unanimously voted to hold them. They do not feel the hearings will duplicate other Congressional activities in the field of energy resources—closest thing to it this year was a bill to create a National Fuels Policy Study Group (vetoed by President Eisenhower). The group expects to draw heavily on testimony from experts from "Resources for the Future, Inc" a continuing private study foundation.

Witnesses generally are conservative, knowledgable experts, noted more for contributions to their respective industries than any partisan activities.

Electric power witnesses will include Philip Sporn, president of American Electric Power; Veryl Hoover, Wyoming Division manager of Pacific P&L; Francis Adams, Power Bureau chief of FPC; Commissioner Arthur Kline, also of FPC; and Walter Zinn, president of General Nuclear Engineering Corp.

Other witnesses will represent the coal and petroleum industries, nuclear and solar energy, officials regulating the gas and oil industries, and Resources for the Future, Inc.

All in all, it should be an interesting and informative procedure.

Nuclear Notes

Sites for two major nuclear power plants, one in Canada and one in the United States have been announced this month.

Site for Florida's first nuclear power plant has been purchased by Tampa Electric Co and Florida Power Corp; comprising the Florida West Coast Nuclear Group. It is 700 acres of abandoned phosphate land in Polk County, Fla., 35 miles east of Tampa and close to the transmission lines of both companies. Here the companies plan to build, in the next four years, a 50-Mw, high-temperature, gas-cooled, heavy-water-moderated nuclear power plant costing $26-million. The research and development program to develop plans for the plant is expected to cost $18 million and will be shared jointly by AEC and the East Central Nuclear Group.

Site for Canada's first large scale nuclear plant has been picked by Ontario Hydro. It's 9 miles north of Kincardine on Lake Huron. The 2,300 acre site, if okayed by the Atomic Energy Control Board, will be the location of the 200,000 kw CANDU (Canadian Deuterium-Uranium) nuclear electric station to be built by Atomic Energy of Canada, Ltd. at a cost of $60,000,000.

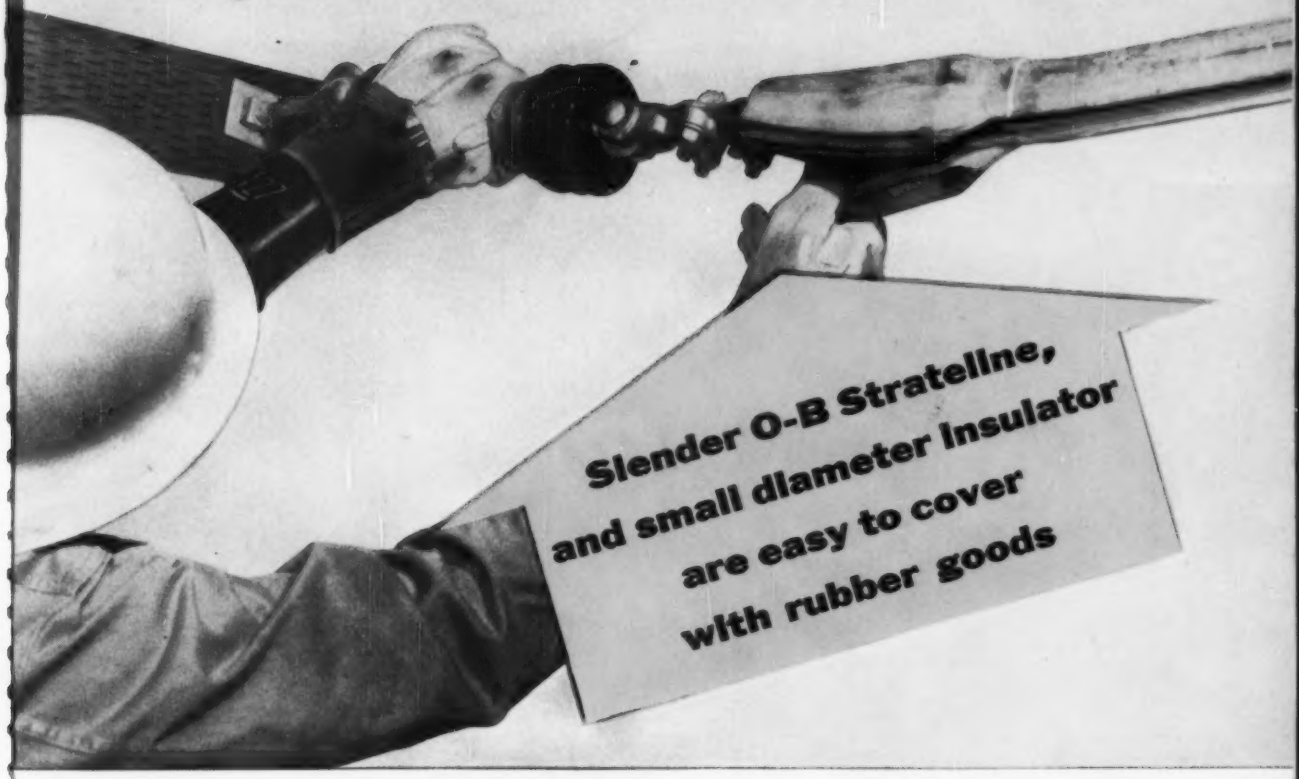
Picked from among 13 firms, Gibbs and Hill, Inc, will design for AEC the small 16,500 kw pressurized-water nuclear power plant it announced Aug. 4. Contributory participation is still being sought among cooperatives and public power agencies. They are being asked to provide a plant site, turbine generator facilities, and associated buildings and services as a minimum contribution. Also expected is responsibility for operation of the plant and purchase of reactor-produced steam from AEC.

International Atomic Energy Agency will soon handle its first bilaterally-agreed nuclear fuel transaction. Last week Austria requested six kilograms of finished fuel elements of 90% U-235 at $17.00 per gram of uranium for its Seibersdorf reactor. The fuel elements will be made in the U. S.

A workshop on industrial use of radio-isotopes will be sponsored by four Connecticut utilities early next year at Yale. Given in cooperation with the Connecticut Development Commission and The AEC's Office of Isotope Development, the two-day program will include fundamentals of radio-activity, instrumentation and measurement, and training and education for industrial use. The sponsoring utilities are CL&P, UI, HELCo, and Housatonic Public Service.

Sargent and Lundy is to design an experimental low-temperature process heat reactor of the pressurized water type for AEC. It will produce heat for industrial application, rather than electricity. Proposal is that such reactors be used by manufacturing industries, and for generation of heat for saline water conversion. Dept of Interior is known to be seeking AEC help in building a reactor of this type in conjunction with a sea water distillation plant to be built on the West Coast.

They're made to work hot!



For deadends that have to be worked hot, here's the ideal insulator-hardware combination:

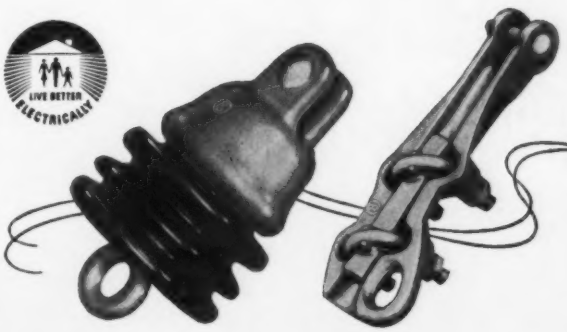
1 -- The O-B Strateline clamp
2 -- The O-B 4¼-inch diameter insulator

Before the present Strateline design was approved, it was submitted to two of the leading manufacturers of hot-line tools for testing in actual applications. Their verdict: "Ideal for hot line work." Their reasons: the captive keeper piece, the long U-bolts, the conveniently located loop, the rounded nuts.

Ideal companion for the ideal clamp is the 4¼-inch-diameter Catalog 42399 insulator. It carries the same 10,000-lb. M & E rating as a standard six-inch unit. Its smaller diameter reduces the amount of clearance needed for forming jumper loops.

If you're looking for extra convenience and speed in working deadends hot, we suggest you consider these two quality items. Your local Graybar man will be glad to discuss your needs with you and to cooperate in keeping a stock of both items in his warehouse.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.



LIVE BETTER ELECTRICALLY

These products distributed by GRAYBAR ELECTRIC COMPANY

Ohio Brass HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

4954-H

THIS IS CORONA EFFECT

SPECTACULAR—
BUT IT'S ONE OF HIGH-VOLTAGE CABLE'S WORST ENEMIES

Corona means crown. It can also mean trouble for ordinary high-voltage cable—because corona is also the name for a low-energy electrical discharge (the glow around the crown at left) which actually cracks and splits ordinary rubber insulation. How? By ionizing any air in between and around conductor and insulation, it creates ozone, ultraviolet light, and certain nitrogen compounds.

And ozone, for example, works itself into ordinary rubber insulation and splits the long-chain rubber molecules. In time you see the costly result—cracked insulation and cable failure.

HERE'S ANACONDA'S ANSWER

Butyl—the most effective rubber insulating material ever developed—has inherent resistance to ozone. And—to aging, moisture, and heat.

But—butyl handles differently from other rubbers. Additives, usually in the form of finely divided powders, are extremely difficult to disperse uniformly in the raw butyl. Butyl also presents special vulcanizing problems. In short, proper manufacture of butyl insulation requires specialists and specialized equipment at every manufacturing step.

That's why Anaconda built a new plant for just one product—Anaconda Butyl (AB) Cable. The men behind this specialized equipment have but one job too—to study and improve the design and manufacture of butyl-insulated high-voltage cable.

This specialized manufacture and specialized inspection, test and quality control are part of the reason why Anaconda Butyl (AB) Cable means long-range economy and reliability, and why you should specify (AB) to protect your investment in high-voltage cable.

Send for publication DM 5903: High-Voltage Durasheath* Cable to Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 59257

ASK THE MAN FROM

ANACONDA®

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE

COMPARE

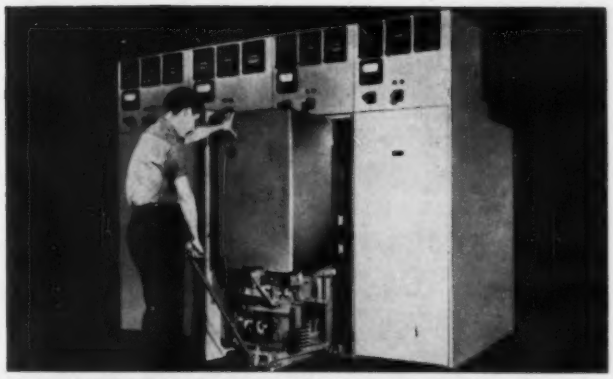
It's easy to see how far I-T-E equipment is ahead of other makes. Just make a point-by-point comparison. Take the new K-LINE circuit breakers for low-voltage switchgear, for example.

Note the new pulldown handle and stored energy mechanism that give you quick-made closure for longer contact life and greater operator safety. With the front door closed, you can draw the breaker all the way out to disconnect position.

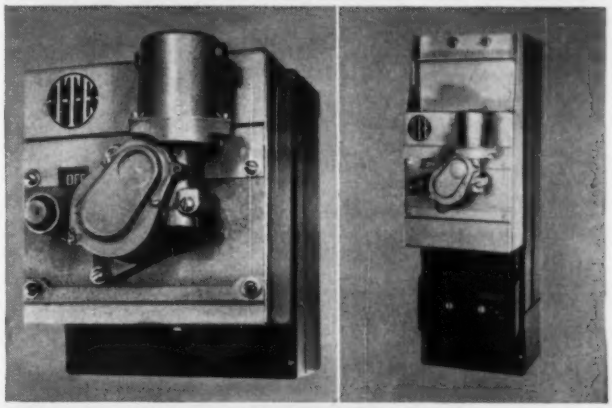
And the new expanded range trip adjustment lets every breaker handle a wider range of loads without modification.

In ratings up to 600 amp, these compact circuit breakers stack four high in standard I-T-E enclosures. For added flexibility, you can shift the low rating breakers to the larger enclosures when convenience dictates.

How much more do you pay for all these extra features? Nothing! It's an I-T-E policy. More value for your money.

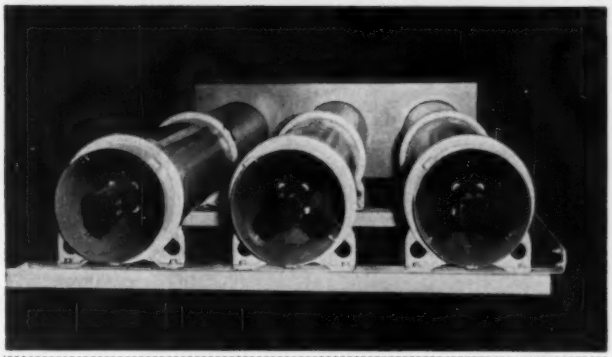


Metal-clad switchgear you can be proud of. Extra sturdiness for longer life. Extra craftsmanship for finer appearance. Extra safety for greater personnel protection. All components are completely accessible. Even rear doors are hinged. Advanced design, uniform-flux-density coils mean extra protection against heavy fault current. A complete line of circuit breakers in both 4.16 and 13.8 kv ratings.



Push a button . . . operate the CORDON.® Here's molded case economy with remote control luxury. New I-T-E CORDON circuit breakers are available with new TELEMAND* motor-operators for remote opening, closing or resetting. CORDON circuit breakers provide up to 100,000 amp interrupting capacity in roughly half the switchboard space required by alternative devices. They cost approximately ⅓ less. TELEMAND operation is available on the complete range of molded case and CORDON circuit breakers from 70 through 800 amp.

**Trademark, I-T-E Circuit Breaker Co.*



Safer, more compact main bus. Not a single case of phase-to-phase short circuit has ever been reported on I-T-E Isolated Phase Bus since I-T-E introduced it 22 years ago. Such performance is proof of good design and consistently high-quality construction. I-T-E uses cylindrical enclosures for superior heat dissipation, easier gasketing, lower cover losses, better shape retention with internal pressure, and saving in weight. Sliding covers permit easy inspection. Full line of auxiliary equipment available. Ratings from 4.16 to 34.5 kv and through 20,000 amp.

SEND COUPON

Get complete, up-to-date information on I-T-E equipment.

I-T-E Circuit Breaker Company U-4

1900 Hamilton St., Philadelphia 30, Pa.

- ☐ K-LINE LV switchgear (600 v)
- ☐ Metal-clad switchgear (4.16 and 13.8 kv)
- ☐ Motor-operated molded case circuit breakers
- ☐ Primary unit substations
- ☐ Other_____
- ☐ Outdoor substation structures
- ☐ Isolated phase bus
- ☐ Reclosers
- ☐ Distribution cutouts

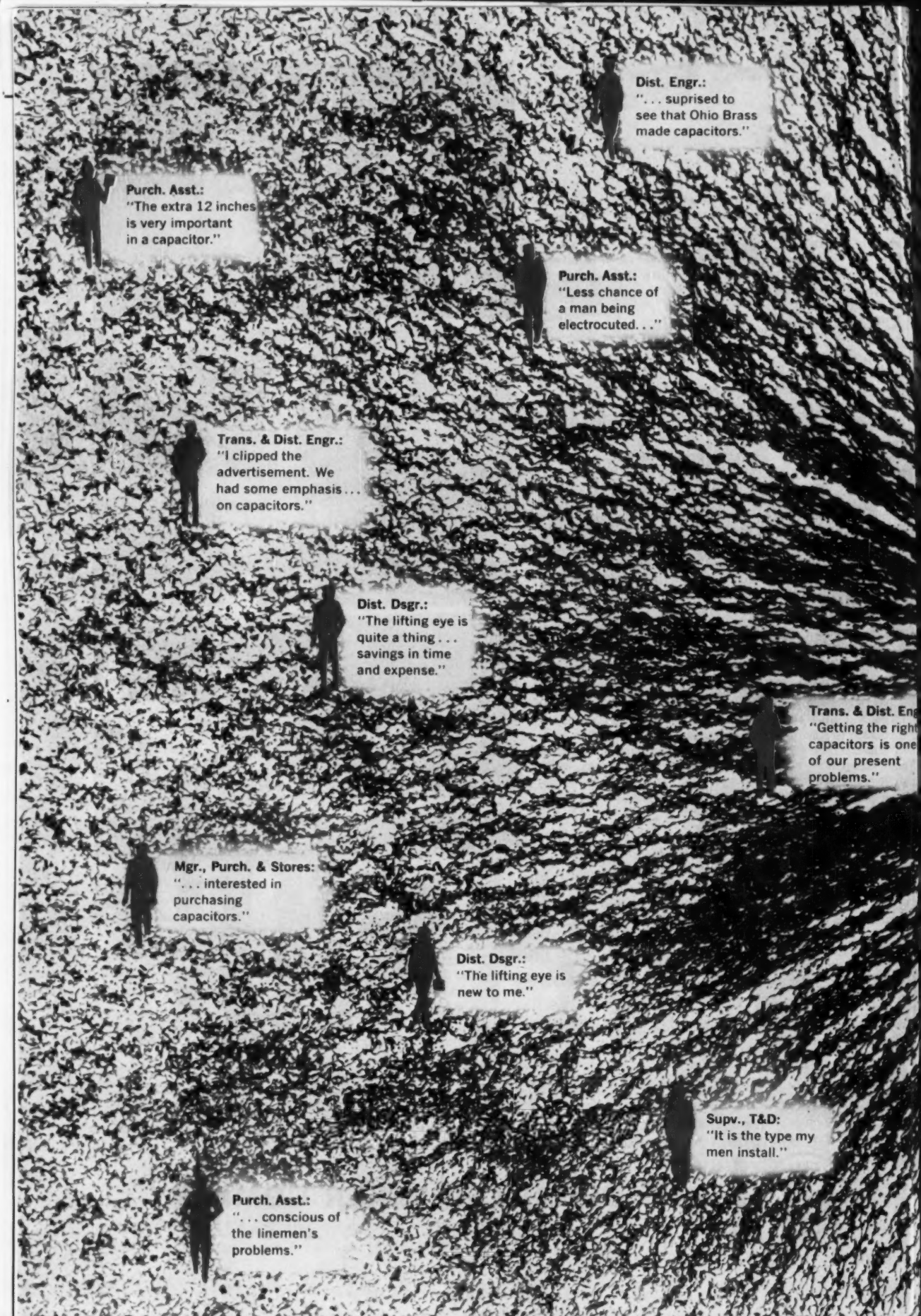
Name_____ Title_____

Company_____

Street_____

City_____ Zone_____ State_____

I-T-E CIRCUIT BREAKER COMPANY


Dist. Engr.:
". . . suprised to see that Ohio Brass made capacitors."
Purch. Asst.:
"The extra 12 inches is very important in a capacitor."
Purch. Asst.:
"Less chance of a man being electrocuted. . ."
Trans. & Dist. Engr.:
"I clipped the advertisement. We had some emphasis . . . on capacitors."
Dist. Dsgr.:
"The lifting eye is quite a thing . . . savings in time and expense."
Trans. & Dist. Eng
"Getting the right capacitors is one of our present problems."
Mgr., Purch. & Stores:
". . . interested in purchasing capacitors."
Dist. Dsgr.:
"The lifting eye is new to me."
Supv., T&D:
"It is the type my men install."
Purch. Asst.:
". . . conscious of the linemen's problems."

Proved sales attraction

Up to 12 Inches Extra Clearance at Pole Top

Provided by Low Height of VAREY Capacitor, and Central Lifting Eye

Low height of Varex, plus inches saved by lifting eye location, provides extra clearance, often eliminates need to move primary.

Just a few inches can make a critical difference when capacitors are being installed on distribution lines. To get the necessary clearance for moving the capacitors under the primary and into the rack, it's often necessary to move the primary with hot sticks . . . with a considerable loss in time.

Varex capacitors give you as much as 12 extra inches of clearance at the pole top. Often they can mean the difference between merely covering the primary and the need to move it completely out of the way.

Here's where the difference comes from.

First, Varex 50-KVAR capacitors are as much as two inches lower than other brands.

Second, the Varex lifting eye is centrally located between the bushings. There's no need to put a complicated sling arrangement around the unit. A hook, clevis, shackle, or whatever attaching device you prefer, can go right down between the bushings. The result: a gain of another six to eight inches in clearance.

It's obvious that designers of Varex capacitors understood your installation problems. Everything has been done to make installation fast and easy.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Central lifting eye lets engaging sling straddle, making it easy to manoeuvre.

Ohio Brass

Electrical World

The electrical industry's weekly magazine

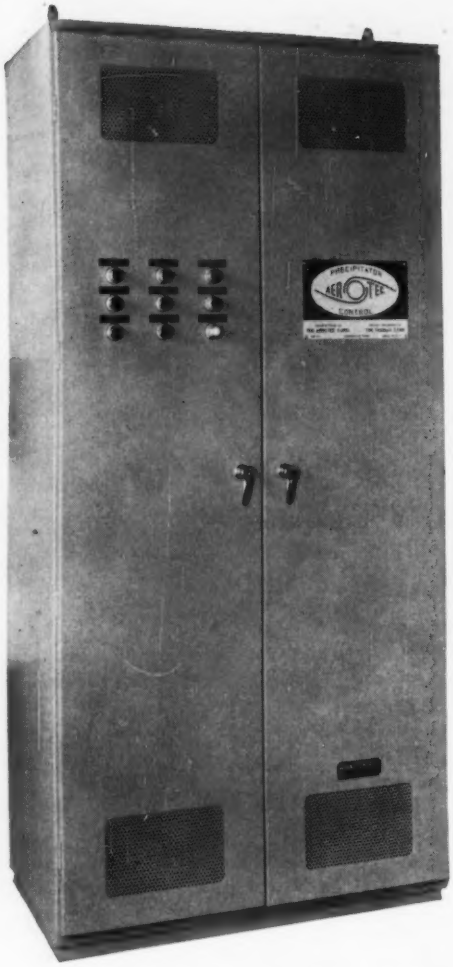
A McGraw-Hill Publication

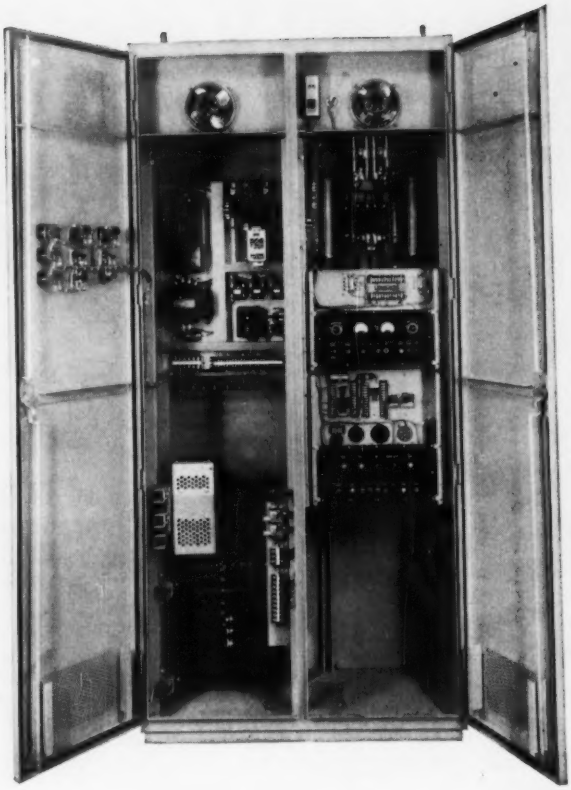
330 West 42nd Street, New York 36, N.Y.

See how this Ohio Brass ad in Electrical World penetrated its market. It found T&D engineers working on specific capacitor problems. It found distribution designers who appreciated the lifting eye feature, and its savings aspects. . . . purchasing men with an eye to the linemen's problems . . . T&D engineers with an alertness for capacitor information. And it found a distribution engineer who hadn't known this manufacturer made capacitors before reading the ad.

Research shows that, on the basis of four readers per copy, around 17,000 interested prospects went through this ad thoroughly. That's a cost of less than 5¢ for each of these "sales calls in print."

Businesspaper advertising is the *only* way—at *any* price—to buy mass sales communication with unknown prospects at the moment they are ready to think seriously about your type of equipment. It is one of your most valuable marketing tools. Don't fail to use it effectively!





Aerotec Electrical Precipitator Control Monitors Optimum Power 120 Times Per Second

This Aerotec precipitator control takes a look at voltage-current conditions *120 times per second!* It makes adjustments at the same fast speed—so you always get peak efficiency.

Developed by Aerotec Industries, this complete, compact unit operates on an entirely different basic principle of automatic control. It has proven itself in numerous installations by boosting power levels to give striking improvements in stack gas appearance.

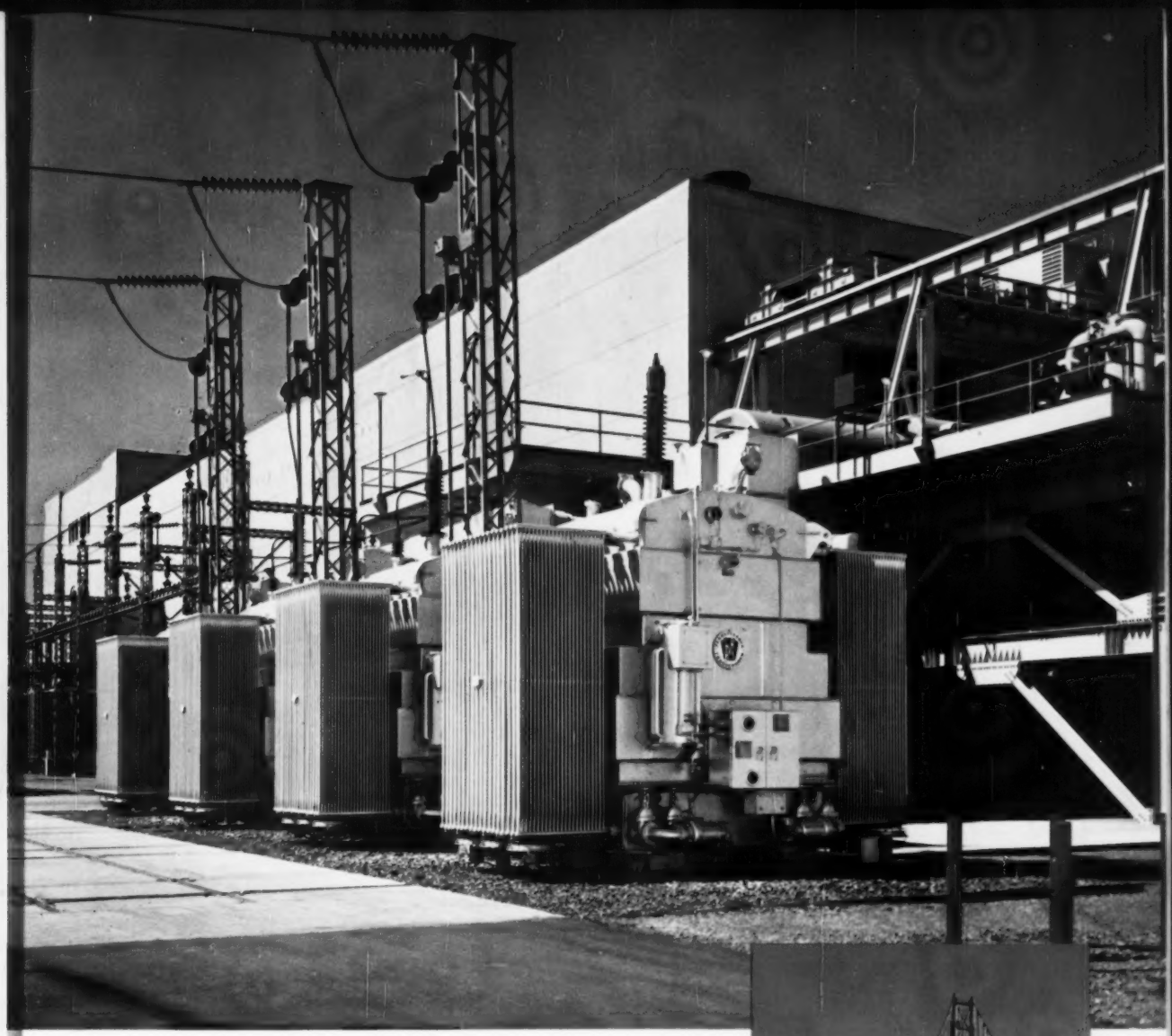
Heart of the automatic packaged control is a pair of power thyratron tubes connected in inverse parallel. Results: Rapid monitoring with instant response . . . High-speed voltage adjustment . . . Quick cut-off that eliminates destructive arcing by quenching excessive sparking.

If your problem is air pollution control, call on Aerotec Industries 30 years' experience in dust collection. Write for more information on mechanical, electrical or series collectors.

AEROTEC INDUSTRIES, INC.

INDUSTRIAL DIVISION, DEPARTMENT L. GREENWICH, CONNECTICUT

FAN-STACKS • BLOWERS • CURTAIN DAMPERS • AIR PREHEATERS • MECHANICAL AND ELECTRICAL DUST COLLECTORS FOR INDUSTRIAL PROCESSES AND FLY ASH • GAS SCRUBBERS FOR CHEMICAL PROCESSES AND NATURAL GAS TRANSMISSION LINES



200,000-kva Bank for San Francisco Bay . . .

PG&E installs 4 single-phase
PENNSYLVANIA POWER TRANSFORMERS
for Unit No. 4 at Hunters Point

Located on the west shore of San Francisco Bay, Pacific Gas and Electric Company's Hunters Point Power Plant has undergone a tenfold expansion of capacity since the plant was built in 1929. The most recent addition—a fourth generating unit producing 165,000 kilowatts—increases the total capacity of the steam-operated plant to 427,000 kilowatts.

The four single-phase, 40,000/53,333/66,667-kva Pennsylvania Power Transformers serving Unit No. 4 feature Pennsylvania's Contour Design. This shell-form construction reduces size and weight, permits one-piece upright shipment and facilitates installation. Additional savings in size and in weight were made possible by Pennsylvania's recommendation that the transformers be designed with forced-oil-to-air cooling for *both* middle and top ratings.

Three of the transformers are "on the line" and the fourth unit is used as a spare. The transformers step up the generated voltage of 18 kv to 110 kv for transmission to a substation, four miles away, through underground, high-pressure, gas-filled, pipe-type cables.

Pennsylvania has the experience and the facilities to satisfy *any* power transformer requirements, regardless of ratings and other specifications. For information or a quotation, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

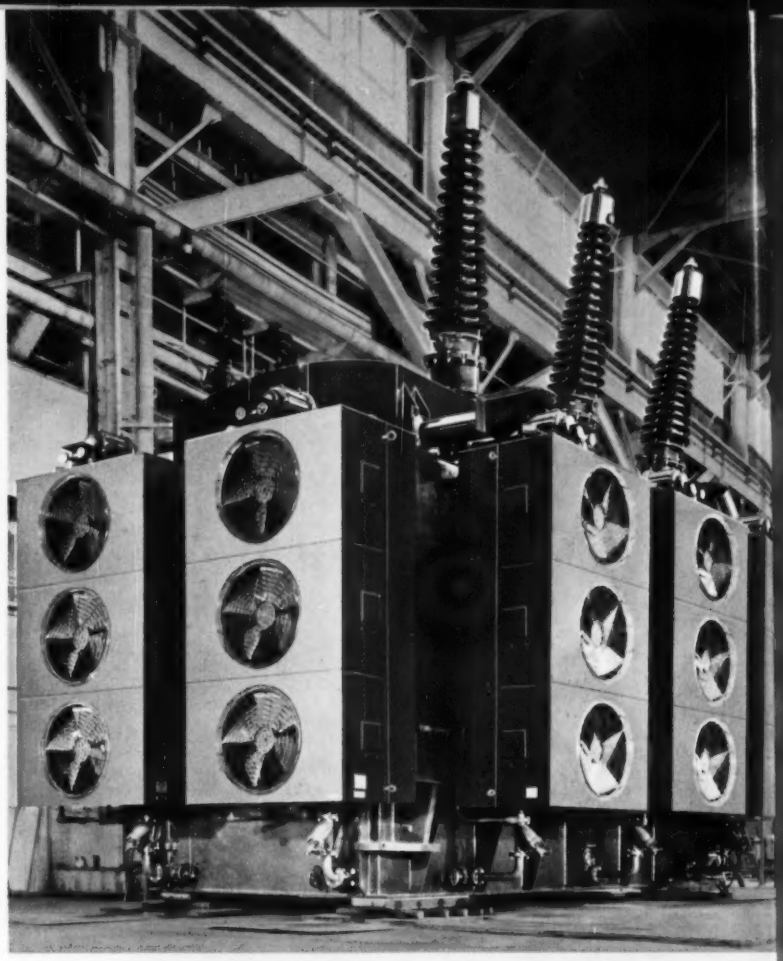
See next page for some facts on facilities . . . . . .

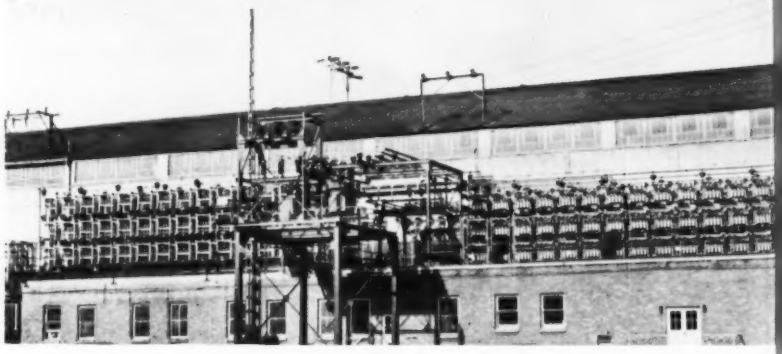
PENNSYLVANIA TRANSFORMERS

PENNSYLVANIA POWER TRANSFORMERS

Pennsylvania has the facilities and the capability to meet the largest power transformer requirements

- A large, expertly staffed engineering department with long experience in power transformer design — both core form and shell form.
- The ability to design and construct scale models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.





ROOF-TOP CAPACITOR BANK SERVES POWER TRANSFORMER TESTING AREA

see other side for installation view

The ever increasing demand by utilities for larger capacity transformers with higher voltages necessitates a greater-than-ever flexibility and capacity in transformer testing facilities. Among the steps that Pennsylvania Transformer has taken to provide necessary testing capacity, is the installation of a 50,000-kvar capacitor bank on the roof of a building adjacent to the main testing area.

By supplying a source of reactive power that is completely unaffected by loads elsewhere in the plant and/or on the utility's system, the capacitor bank permits temperature tests to be scheduled and conducted under the most efficient possible conditions. The largest transformers being manufactured today can be tested. Among the units recently "checked out" is the 315,000-kva, 230,000-volt Pennsylvania Power Transformer shown above.

PENNSYLVANIA TRANSFORMERS

McGRAW EDISON

PENNSYLVANIA TRANSFORMER DIVISION

McGRAW-EDISON COMPANY • CANONSBURG, PENNSYLVANIA • GREATER PITTSBURGH DISTRICT

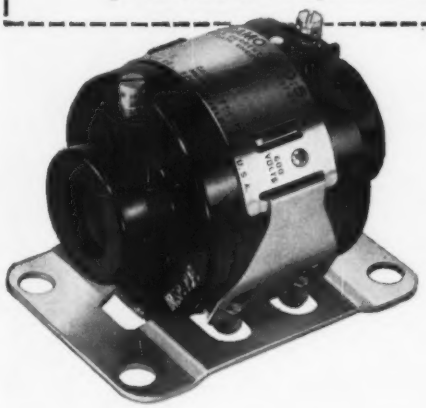
Developed to Meet Your Needs:

A Complete Line of CURRENT TRANSFORMERS to accurately measure loads from 20 to 1600 Amperes

Type BH Transformers

Single or Dual Range—Completely Color Coded

Sangamo Type BH (Big Hole) Transformers come in single range 200 to 800 ampere ratings and in the unique dual range 200/400 or 400/800 ampere ratings that reduce transformer changeouts. BH Transformers provide more cable space—more installation room—easier cable insertion. They are molded in colored epoxy resins of standard resistor colors to let you determine ampere rating at a glance—even when the units are mounted near the top of a pole. Request Bulletin 503.



Type R Transformers

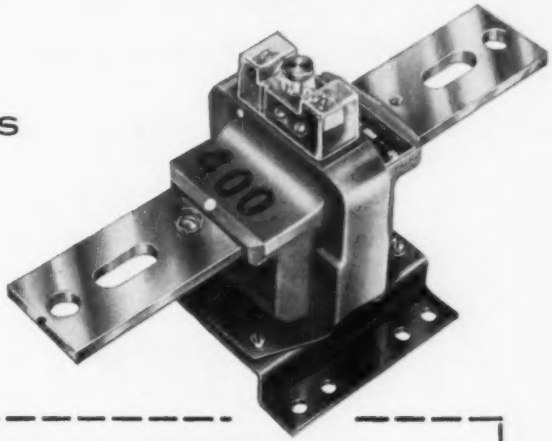
...for flexibility of application

Type R Transformers are light enough to be supported by the primary conductor alone, and are available in eight variations that give you unusual freedom in devising simple, cost-cutting installations for your system. See for yourself how these transformers can provide flexibility to meet growing needs. Request Bulletin 150 D.

New Type MV-6 Transformers

...for indoor installation

Here's a new wound-type current transformer that will reduce the cost of metering installations where more expensive weather-proof transformers are not required. The 400 ampere Type MV-6 meets the 0.3 A.S.A. Accuracy Classification for B-0.1 and B-0.2 burdens. Molded in epoxy resin. Bulletin 150D (1) gives full information.

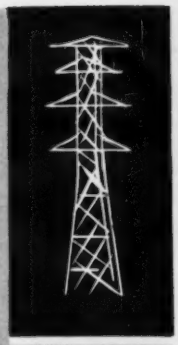


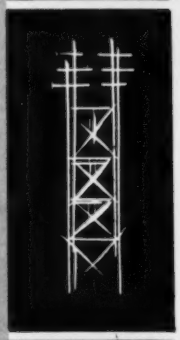
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

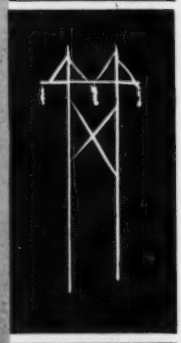
SERVICE

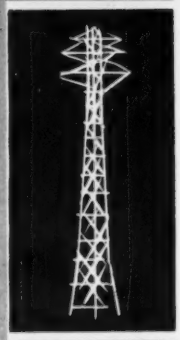
is our

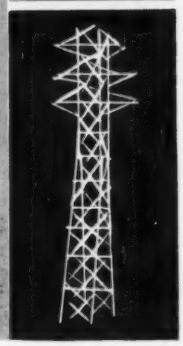
MIDDLE NAME!











PROVEN BY OUR

40

YEARS

of cooperation with many of America's most progressive public utility industries!

Founded in the year 1919, the Hoosier Engineering Company has for the past 40 years served the electrical industries with reliable electrical contracting service. Our years of experience enable us to fill the ever growing need of the electrical industry with a competent transmission, distribution and maintenance service.

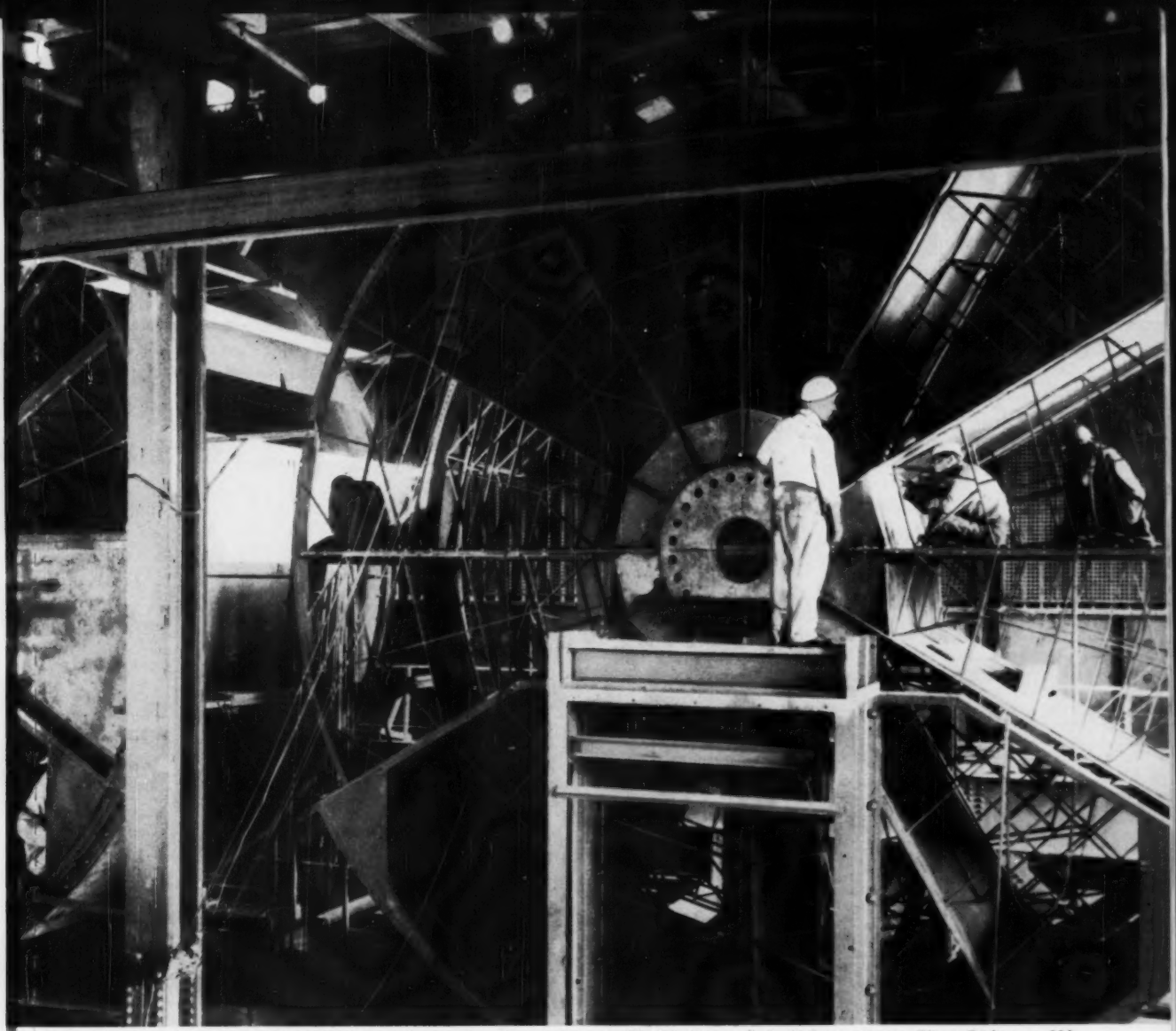
40TH ANNIVERSARY YEAR

HOOSIER *Engineering Company*

ERECTION AND MAINTENANCE OF ELECTRICAL TRANSMISSION AND DISTRIBUTION LINES

1350 HOLLY AVENUE • COLUMBUS 8, OHIO

Address replies to BOX 418, COLUMBUS 16, OHIO



Two of the four Ljungstrom Air Preheaters under construction at Potomac Electric Power Co.'s Dickerson Power Plant, Dickerson, Md. Each pair of these Ljungstroms, with a combined heat exchange surface of 475,000 sq. ft., will serve one boiler, evaporating 1,300,000 lbs of steam/hr. The first 175,000 KW unit was placed in operation in June this year and a duplicate unit is now under construction.

AIR PREHEATER SERVICE

PROTECTS POTOMAC ELECTRIC POWER CO.'s NEW **LJUNGSTROMS**® TWO WAYS

From the moment they start—and for as long as they operate—these Ljungstroms will get double-header Air Preheater service: protection against routine wear, and insurance of maximum operating efficiency. This is how.

Lifetime Air Preheater Service provides regular inspection and the services of expert technicians throughout the life of each unit. Air Preheater engineers make personal calls at least once a year on every Ljungstrom installation to make sure that all units are in top condition. This type of service is still in effect on Air Preheaters dating from 1923.

Rapid factory service gives the best possible protection against routine wear, the best insurance of readily-available replacement parts. In one typical case, an Air Preheater customer 500 miles from the factory received *custom-fabricated* parts within ten hours after his initial request for these parts.

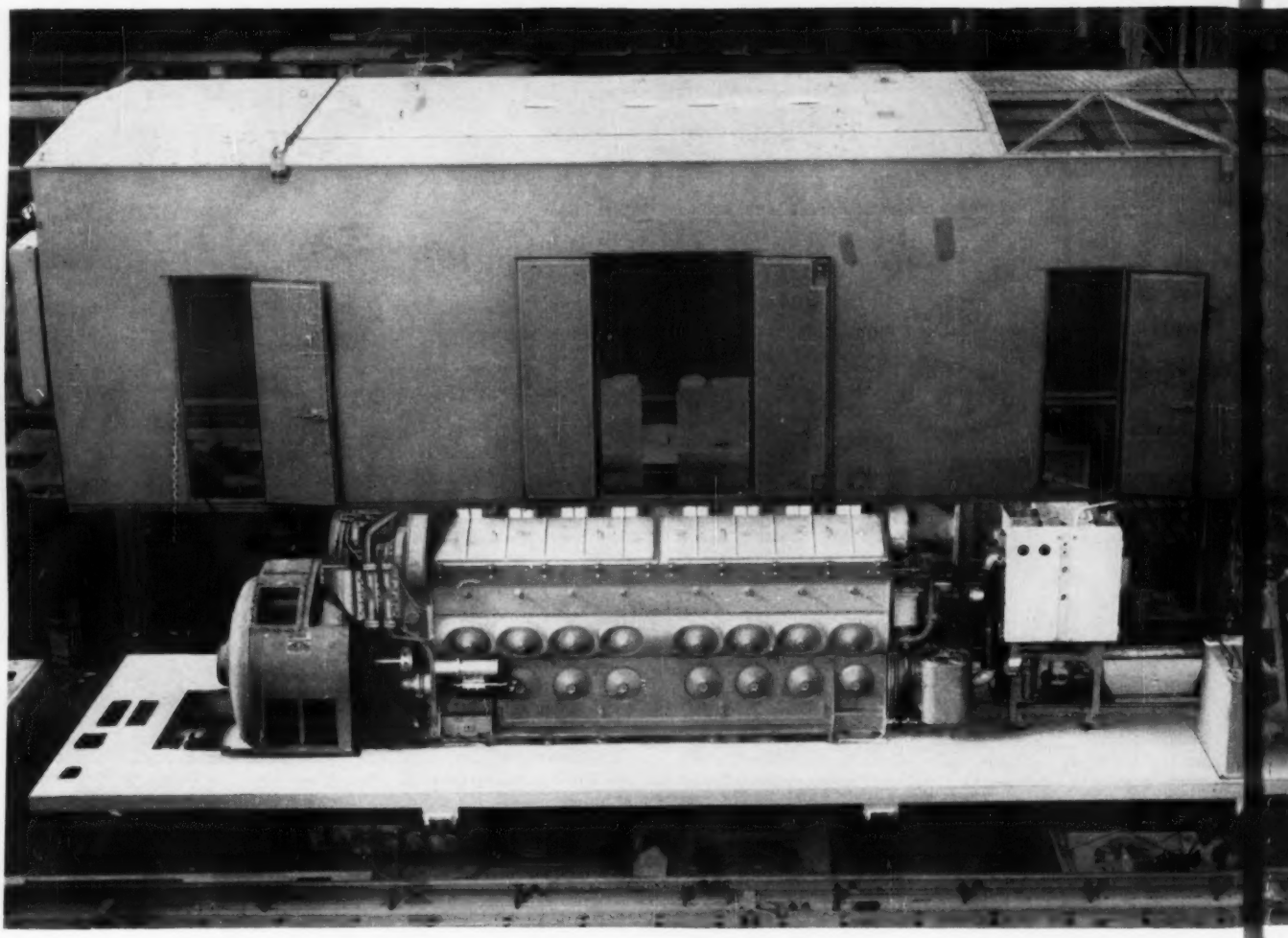
Regular inspection and fast response to emergencies are just two advantages Air Preheater offers its customers. Another is expert knowledge of boiler and preheater problems, gained through 35 years' experience. These reasons—knowledge of our customers' problems and a *continuing* interest in them—probably explain why nine out of ten preheaters sold today are Ljungstroms.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

Push-button peaking plant . . .

FROM COLD START TO



Weather-proofed, sound-deadened housing is lowered over prime mover, generator and supporting auxiliaries. More than 20,000 prime movers and generators have been produced by Electro-Motive over a twenty-one year period.

Entire plant as it appears installed at the step-down substation serving the load. Self-contained, outdoor-type units require no expensive building or complicated foundation work. From time of order to complete installation requires less than five months.

0 FULL LOAD IN 90 SECONDS

Electro-Motive MU-60 provides automatic, unattended supply for peak loads, system reserve, area protection

Within 90 seconds from starting signal, the unattended 6000 KW Electro-Motive plant is on the line at full load—providing an immediate and economic answer to problems of peak demand and spinning reserve. A look inside reveals why this quick response is possible:

First, the MU-60 is composed of components that have been applied to a wide range of applications over a 21-year development period. In thousands of hours, under all kinds of operating conditions, their records of performance have set new standards of reliability, durability, and low maintenance. The result is a standardized plant featuring low first cost,* and low operating and maintenance costs.

Second, the MU-60 prime mover—the famous General Motors 567 series two-cycle Diesel engine—is inherently suited to fast starts and changing loads with long service life.

Finally, the plant's basic control equipment provides for unattended automatic operation at a remote location which makes it an ideal choice for area protection.

Because of standard components and design simplicity, the MU-60 has a high degree of flexibility and operational advantages. For example:

- **Unitized, self-contained design permits economical installation of less than $15 per K.W.**
- **Application at points of load reduces line loss from central locations.**
- **Building-block principle of application permits fitting power needs to area demand and growth.**
- **Plant may be increased in capacity at low incremental cost.**

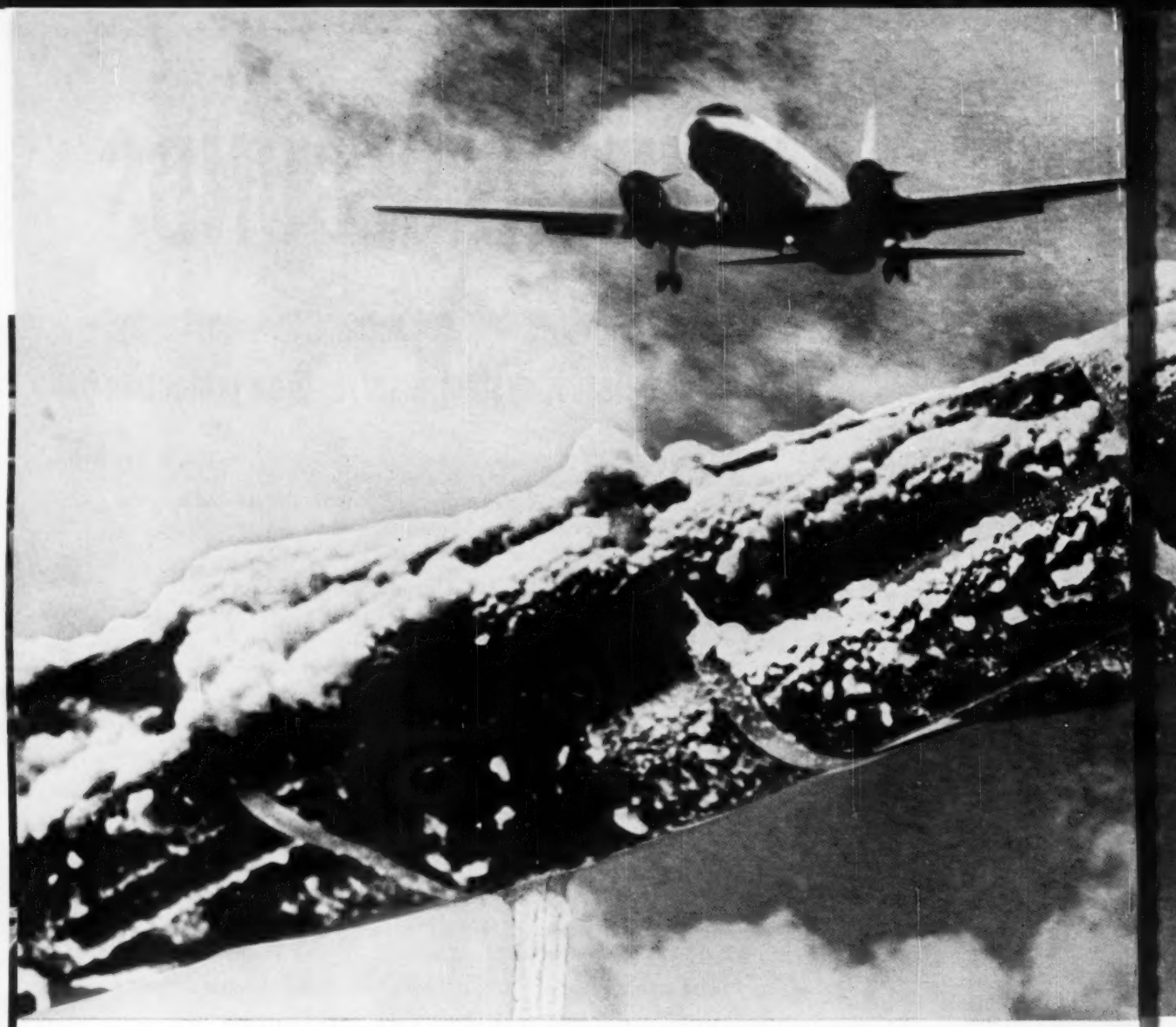
Ask your Electro-Motive representative for additional information about the economy and operational advantages of the Electro-Motive peaking plant.

**$85 per kw, f.o.b., LaGrange, Ill.*

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS • LA GRANGE, ILLINOIS

Sales-engineering offices: Chicago, New York, St. Louis, San Francisco

In Canada: General Motors Diesel Limited, London, Ontario



Pile on the ice and snow!

Let it sleet. Let it snow. Let the wind blow.

This cable can weather the storm.

Rome's reverse-lay preassembled aerial power cable has a built-in, high-strength messenger for staunch support. Falling branches—even some trees—can be supported by the cable itself!

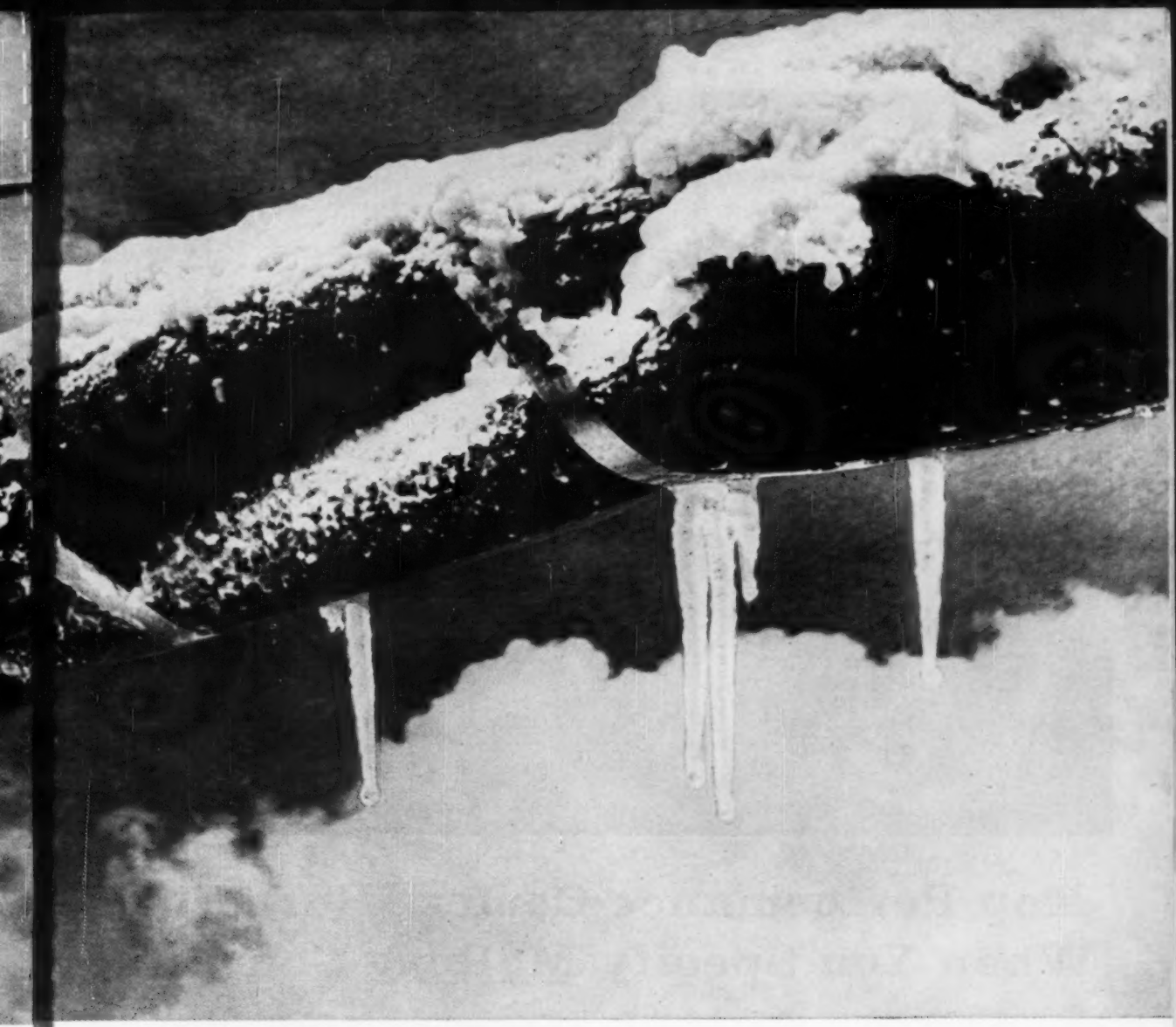
Fewer outages You can use this aerial cable to reduce the chance of outages during storms and high winds. Because it is fully insulated and jacketed for maximum resistance to moisture and tree abrasion, it prevents wet branches from shorting between phases. And it's *safer* for your line crews to handle . . . safer for the public too!

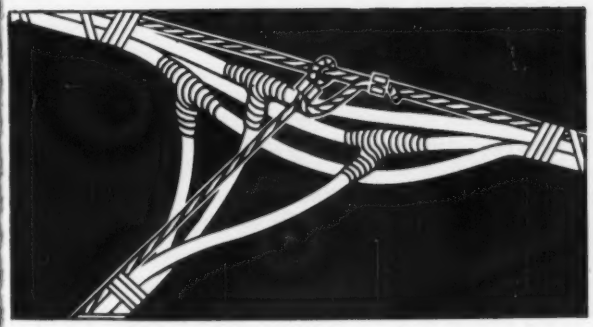
Routing more direct Because it is compact, you can route preassembled aerial cable more directly, with less right of way than is required for open-wire systems. You can run more circuits in less space. Less clearance is required, so you do less tree trimming—initially and periodically!

Wide range of constructions You can get Rome's preassembled aerial power cable in a wide range of constructions, rated up to 15 KV: Rozone (oil-base), Polyethylene, or Rozone A (butyl-base) insulation, Roprene (polychloroprene) or Roseal* (flame-retardant polyethylene) jacketing.

Get all the details from your Rome Cable salesman, or clip and mail the coupon today!

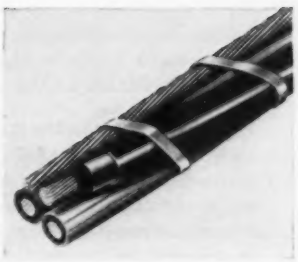
*Trade mark—Patented.





EASE OF TAPPING Long spans sometimes make mid-span tapping necessary. Rome's reverse-lay preassembled aerial cable construction—where the direction of lay of conductors is reversed at regular intervals along the line—permits easy mid-span tapping. The reversed portions provide sufficient slack for taps *anywhere* along the line! This eliminates the necessity of making taps at the pole ends only. Stress is carried entirely by the messenger. Conductors can be untwisted for tapping without cutting—even while the line is hot if conductors are unshielded (5 KV). Your linemen can use wire guards and rubber blankets for safety and make pole-end taps without use of a platform.

BETTER VOLTAGE REGULATION Because of its close geometric spacing as compared with open-wire circuits, aerial cable has a lower reactance. Voltage drop is about half as great as typical crossarm construction and, for a given voltage drop, power can be transmitted twice as far.



ROME CABLE

CORPORATION

Department 1-9, Rome, N. Y.

☐ Please send me more information on the above.

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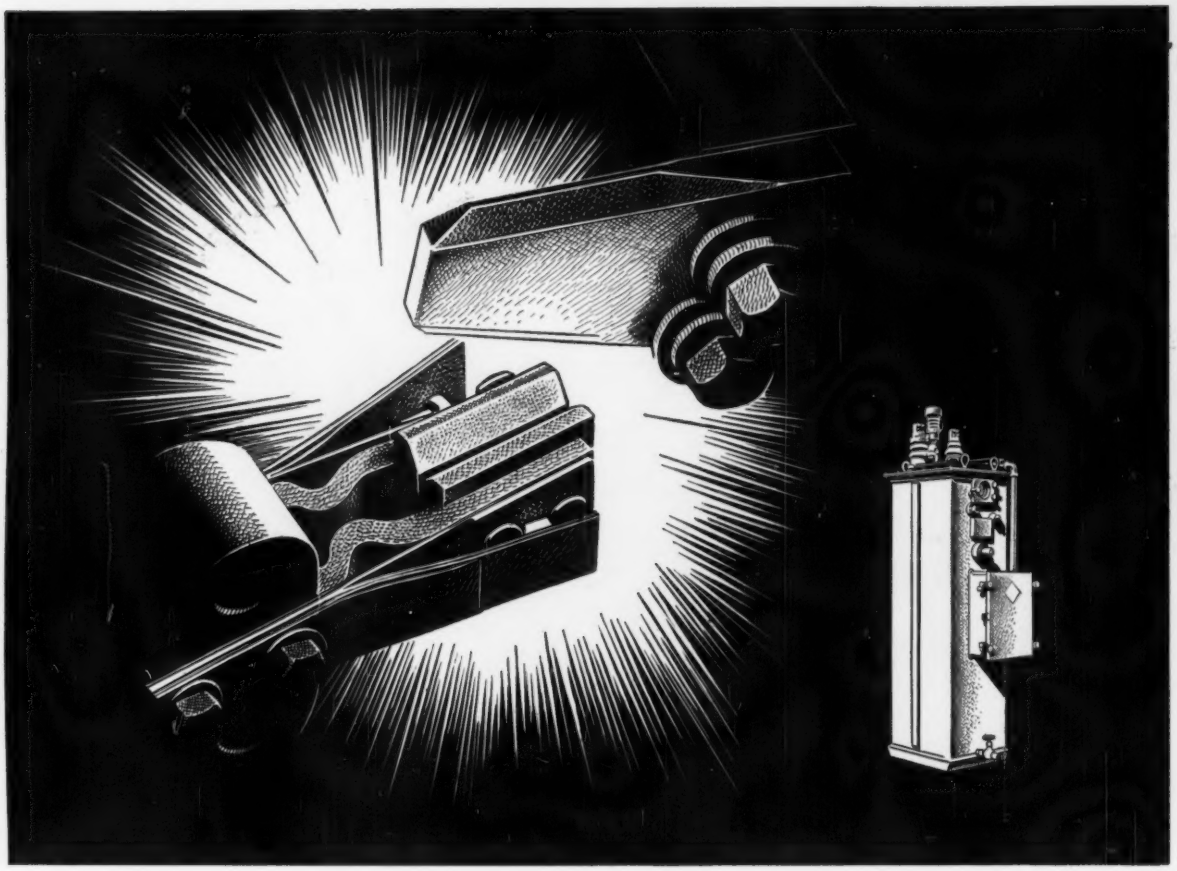
MEET THE MAN

WHO'S DEDICATED TO **YOUR** JOB

YOUR ROME CABLE SALESMAN



Top Performance Comes "Built-In" When You Specify Mallory Contacts

Contacts play an important role in modern electrical gear such as circuit breakers, motor controllers, and voltage regulators. To be sure of top performance in the equipment you buy, it pays to specify Mallory Elkonite® contacts.

Long experience in the specialized science of contact design and manufacturing goes into Elkonite contacts. The combination of density, hardness, micro-structure, resistance to arc erosion, mechanical strength, and other vital characteristics is selected to match the requirements of each application. The particle size of the refractory constituent and processing technique are carefully controlled to produce the characteristics required by the finished contacts.

For many years, Mallory has engineered and supplied contacts for leading manufacturers of switchgear. Be sure that the manufacturer from whom you buy uses Mallory Elkonite contacts. They're your assurance of lasting and dependable performance . . . and they're the hallmark of value-minded design.

Serving industry with these products:

Electrochemical
- Capacitors
- Batteries
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- Vibrators
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Need **color** in a weather-resistant rubber product?

PARACRIL® OZO will give you all the color you want... any color... permanent, gleaming color for every kind of rubber product, from electric wire to oil pump hose to shoe soles.

Now you can give your product powerful extra selling features... color that attracts, that warns, that identifies, that helps emphasize or hide.

Along with color, PARACRIL OZO gives you a combination of weather resistance, abrasion resistance, oil resistance, flex life and other valuable rubber properties far surpassing conventional weather-resistant rubbers.

See if your product doesn't call for PARACRIL OZO. To find out more about this proven new rubber and the properties it offers your product, contact your Naugatuck Representative or write us today.

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IBM® COMPUTERS GIVE TIGHTER CONTROL OF TRANSFORMER LOADS

Today, the tighter control of distribution transformer loadings—made possible by IBM digital computers—is resulting in fewer outages, improved consumer voltage, reduced transformer losses, and scheduled changes.

With this system, customer kw-hr consumption recorded on IBM punched cards gives an up-to-date picture of every consumer's usage. This data is then translated by the computer to the corresponding kva demand figures for each consumer class. The computer now sums the kva demand on each transformer and where this is excessive it signals the overloaded transformer and its location. This enables engineers to make transformer changes on a scheduled basis, at minimum expense and during regular working hours.

IBM digital equipment offers the distribution engineer many advantages: radial fault calculations; determination of most economical conductor sizes; volt drop and loss computations; capacitor placement studies; table look-up operations; fast logical decisions.

Not confined to special purposes, IBM equipment can be used by both engineering and accounting departments for solving the problems of utility systems.

Call your local IBM representative today for more detailed information on IBM digital computers—engineering time-savers you shouldn't overlook.

here's the inside story on Southern States cutouts and boric acid fuse links

While Southern States Distribution Cutouts are designed to function properly with other makes of fuse links, there is a measurable difference in performance when Southern States boric acid links are used—not only in our cutouts, but in other makes, too.

The cutaway view tells the inside story of why Southern States Cutouts and Fuse Links work together to provide the ultimate in fuse protection.

The auxiliary tube of the link is unusually long and sealed to the top ferrule. The fusible element is buried in boric acid powder.

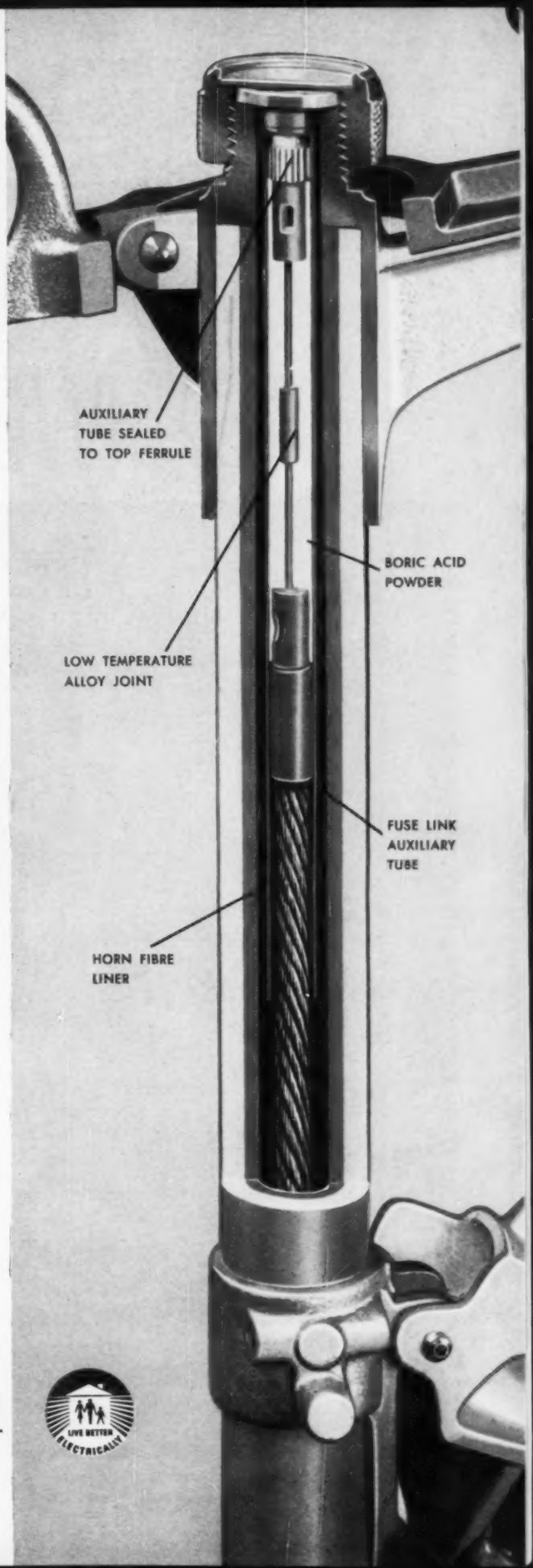
When a fault occurs, even one just sufficient to melt the fusible element, a lot of things happen fast: First, an arc is established when the element separates. The heat generated by the arc instantly converts the boric acid powder into water and then into a large volume of steam. This action performs a dual task. First, vaporization of the water and rapid expansion of gas cools the arc. Simultaneously the arc stream is purged of ionized gas by a fast-moving column of steam.

Circuit interruption is swift and sure.

At higher values of fault current, pressures generated destroy the auxiliary tube. When this happens the main tube takes over, normally clearing the fault in less than a cycle.

For the ultimate in fuse protection on low or high faults, use Southern States Cutouts and Fuse Links.

Get full information from your Southern States representative, or write for Bulletins 58OC and 55PDL.


AUXILIARY TUBE SEALED TO TOP FERRULE
BORIC ACID POWDER
LOW TEMPERATURE ALLOY JOINT
FUSE LINK AUXILIARY TUBE
HORN FIBRE LINER

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

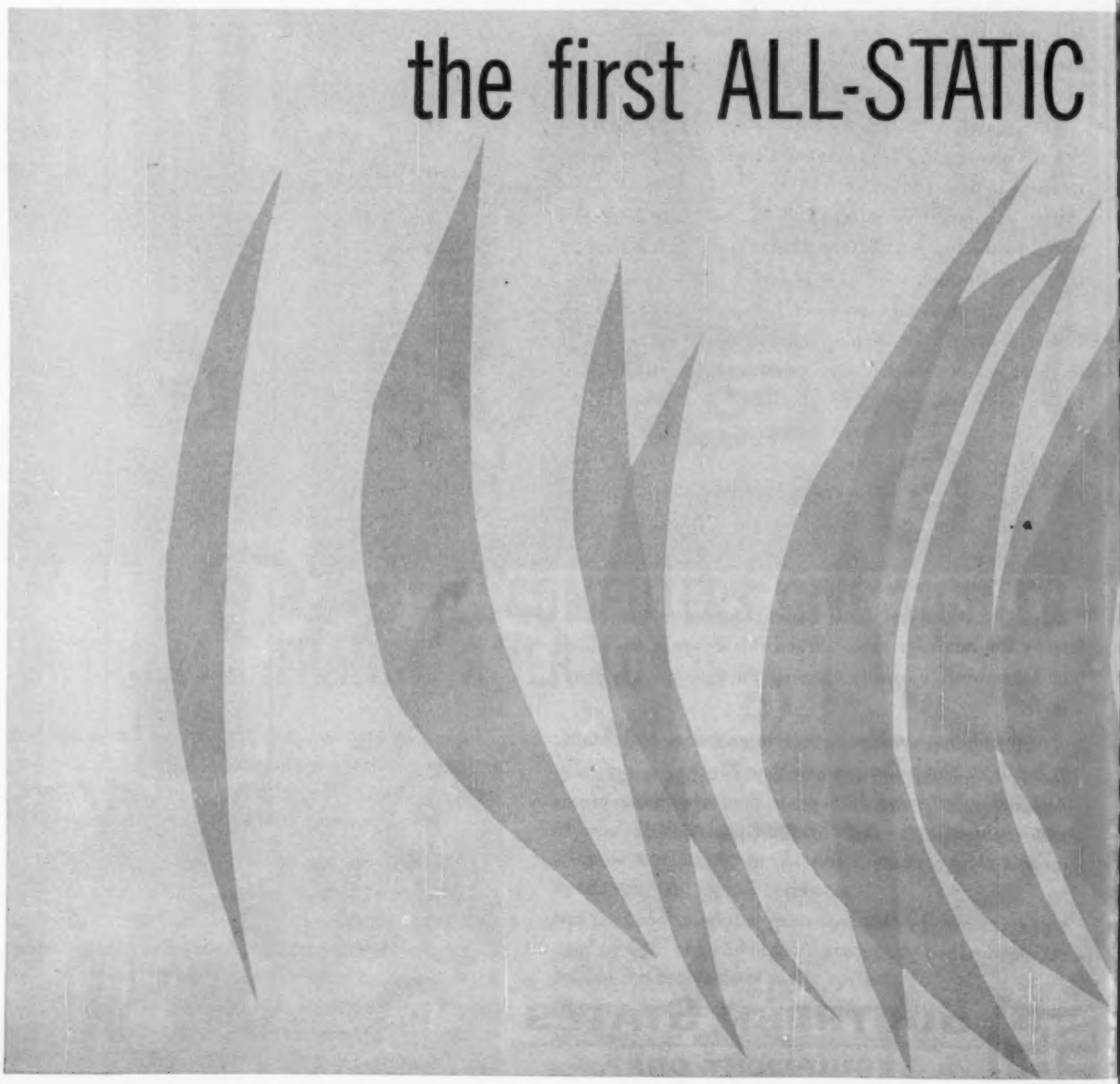
LIVE BETTER ELECTRICALLY

IN CANADA Dominion Cutout Co., Ltd., Toronto

The new Type SA represents a promising start toward realizing the potential advantages that abound in the use of semi-conductors. Based on 21 years of study and experience in static-relaying circuitry that started with our Type HCB relay in 1938, the SA holds promise for low maintenance, better sensitivity, lower op-

WESTINGHOUSE

the first ALL-STATIC



erating energy and more compact construction. Faster response will be limited only by the time required for integration (the thinking and command function).

Protective relaying took a long stride forward with the development of this new Westinghouse 3-phase relay for generator protection.

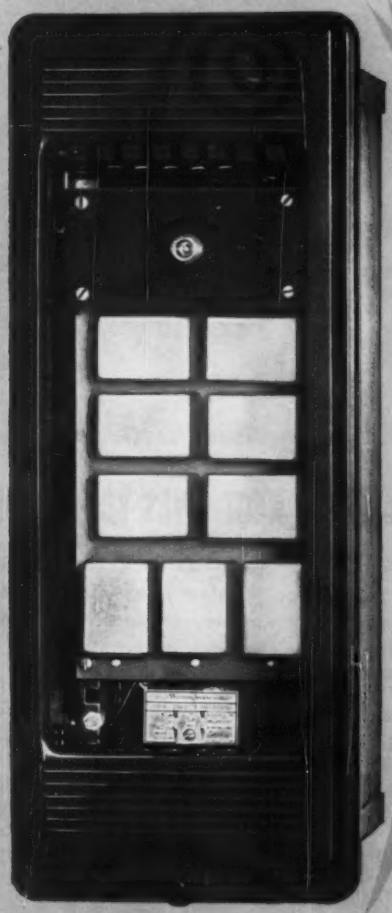
Call your Westinghouse sales engineer to get the story on our work in the field of statics and protective relaying. J-40527

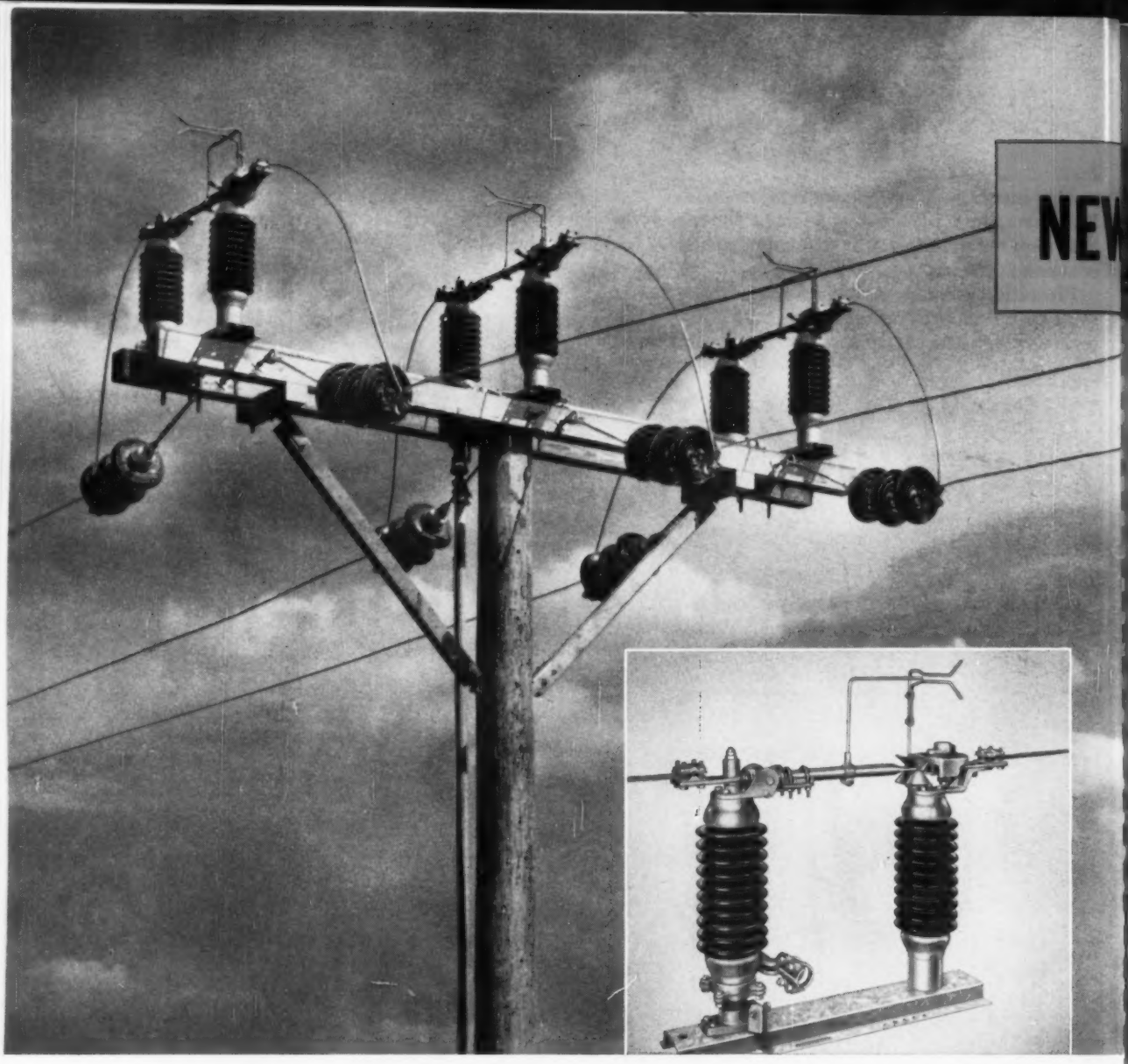
YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS CBS TV FRIDAYS

ANNOUNCES THE SA

differential generator relay





NO OTHER SIDE-BREAK DISCONNECT GIVES YOU ALL OF THESE OPERATING ADVANTAGES

- **Correct contact always maintained at blade tip even if crossarm warpage distorts the switch base.**
- **All blades engage fully in the break-contact jaws without precise adjustment of the inter-phase rods.**
- **Less time and labor to install with Kearney original wide-tolerance mechanical design.**
- **Easiest, surest ice-breaking ability available on both opening and closing.**

This newest Kearney development solves long-existing operating problems of crossarm mounted group operated side-break disconnects. The best supporting structure or crossarm construction may . . . due to ice loads, age, wind or line strain . . . deflect enough to distort the switch bases, or alter the relative positions of the three phases. This often causes loss of contact or failure of all blades to close completely in conventional disconnects with both rigid blades and stationary break-contacts.

Kearney's advanced design features a self-aligning blade constructed to permit controlled vertical movement and axial rotation. This automatically compensates for base distortion . . . keeps the blade tip correctly aligned in the contacts. The break-contact swings 30-degrees with the blade as it is opened or closed, producing high leverage ice-breaking ability and full wiping of the silver current transfer surfaces. On closing, the blade tip fully engages the break-contact before the contact moves from its angular open position, compensating for any shift in position of the switch bases. This same feature also allows considerable freedom in interphase rod adjustment, enabling Kearney *Self-Aligning* side-break switches to be installed faster and more economically than other types.

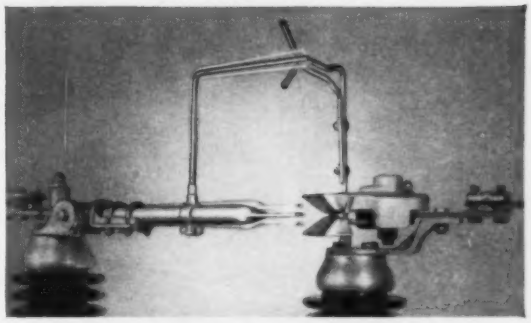
The details of these original features for maintenance-and-adjustment-free operation are shown on the facing page.

Kearney's

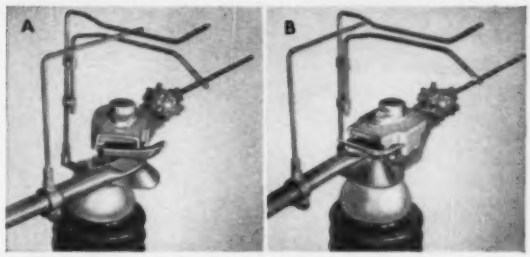
Self-Aligning SIDE-BREAK DISCONNECTS

...always make positive contact, even if the supporting structure warps, twists, bows or settles.

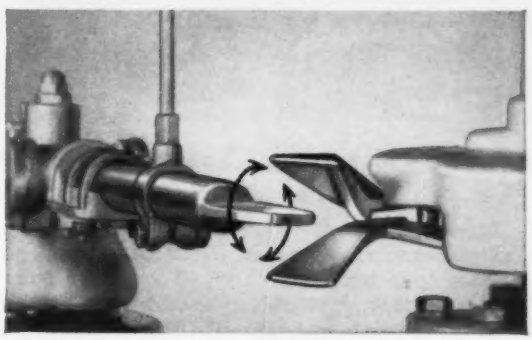
Self-aligning blade moves in a vertical plane to re-establish the original relationship between blade tip and contacts if supporting structure warpage distorts switch base. Wide mouth contact jaws assure blade entry into the contacts. Vertical 1¼" movement more than corrects for extreme cases of misalignment.



Break-contact swings 30° in the plane of blade travel as switch is opened or closed, providing highest leverage ice-breaking and full wiping of the current transfer surfaces. Note that the blade tip is fully engaged, and full contact is maintained (A) through the final 20° of blade travel to the fully closed position shown at (B). This feature allows more latitude in phase rod adjustment than other designs.



Blade rotates 12° on its longitudinal axis. If base distortion has affected blade-contact alignment, the blade tip will rotate as it enters the break-contact to keep all contact surfaces parallel, automatically restoring contact alignment. Friction reducing construction at all rotation points minimizes operating effort.



Switch carries full-rated load current well within NEMA temperature rise, from a fully closed position to 20° partially open position. Ratings available, 7.5 through 69 kv, 600 amperes. Equipped with conventional or whip-type arcing horns... torsional or spade-type operating mechanism. May be mounted horizontally, vertically, or underhung.

For full details talk to your Kearney representative, or write direct for Bulletin 8B.

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

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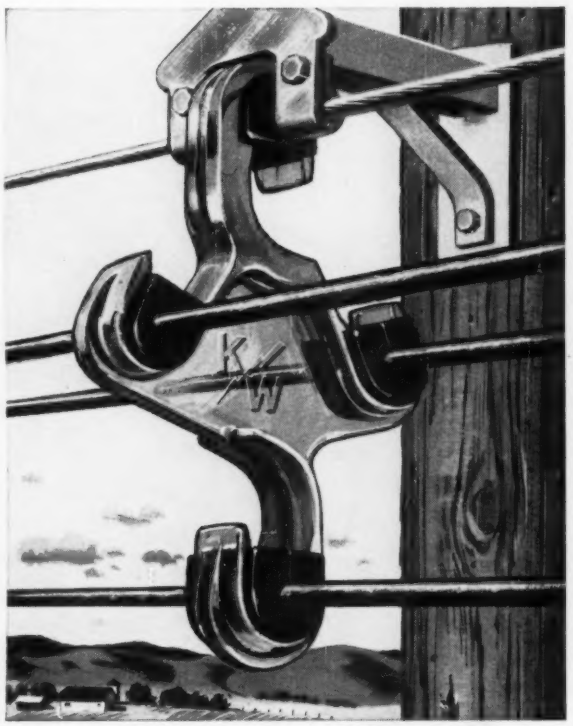
FOR BETTER CONSTRUCTION... SAFER MAINTENANCE

Specify Kearney Products

Plants at: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

NEW KW SPACER TYPE AERIAL ADDS STRENGTH, CUTS COSTS,



One-Piece Design—Supports 1200 Pounds

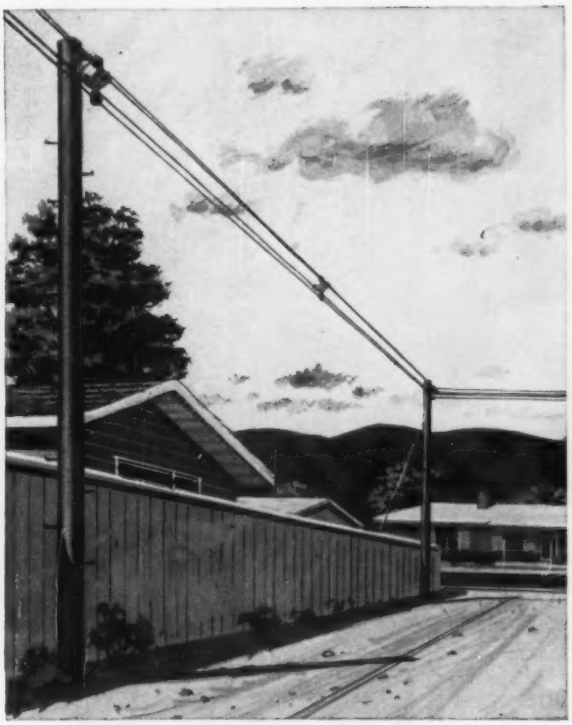
New solid spacer design has no loose parts nor movable pieces . . . it's simple, reliable and strong. Can support a minimum distributed load of 1200 pounds. Easy to install, since only one conductor is handled at a time. Snap-in grommets shaped to ease installation. Can be used with or without crossarms; standard hardware available from many suppliers.

Cuts Material Costs and Tree Trimming

A KW Spacer Cable system can be installed for as little as one half the cost of standard pre-assembled aerial cable!

Compared to open-wire weatherproof, the reduced tree trimming and improved system dependability resulting from messenger supported cables can justify the spacer system's slight additional cost.

CABLE SYSTEM IMPROVES APPEARANCE



Reduced Spacing Improves Appearance

Compared to open wire, closely spaced conductors present a neat, compact arrangement that improves appearance wherever it is installed. Close 6-inch spacing also improves system electrical characteristics . . . permits easy phase identification and proper load balancing. Usual installation practice is approximately 35 spacers per 1000 feet.

WITH its unique new spacer design, KW now offers you unsurpassed dependability and handling ease for cable systems operating at 5 to 15 kv, by using only one spacer for the whole range of voltages.

No tools or tightening necessary: entire spacer system snaps in and locks.

The system consists of four parts: (1) Phase conductors (EC grade aluminum, minimum conductivity 62 per cent, insulated with Polyethylene or Butyl rubber with Neoprene jacket); (2) Special high-strength messenger; (3) Molded one-piece spacers; (4) Molded Neoprene cable-retaining grommets.

Standard hardware is available from leading suppliers. Call your Kaiser Aluminum sales office or KW distributor for immediate service and full information.

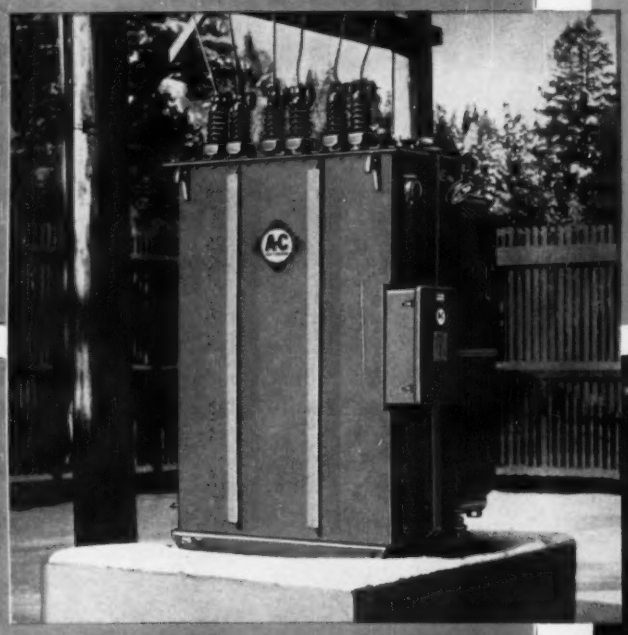
Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM

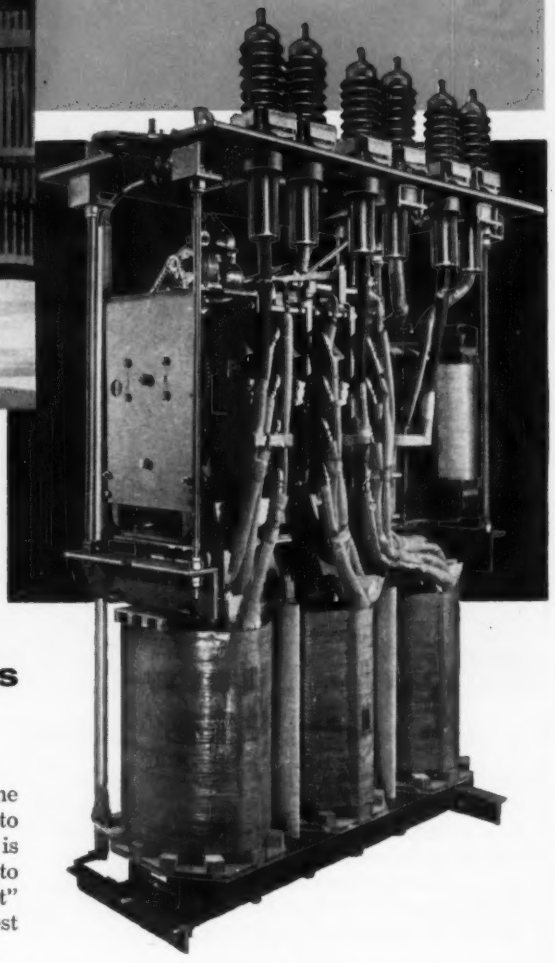
"IF IT CARRIES CURRENT, KW CARRIES IT!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

ALLIS-CHALMERS modern line for '59



standardized components
and unit design



why Allis-Chalmers 3-phase regulators

PACK MORE VALUE

Mass manufacturing of standard components — that's one reason why Allis-Chalmers can put so much value into industry's lowest-priced 3-phase regulators. Another key is *unit construction*. Simplified subassemblies are joined into a complete unit. Suspended from the cover, this "lift-out" unit makes interior readily accessible, assures you the best in construction.

More A-C regulator values: *Caliband* control, "Quick-Break" tap-changing mechanism, unidirectional breather and *Vari-Amp* rating.

Originators of 5/8% step regulators

Regulator facts fast! Call, wire or write...

ALLIS-CHALMERS

Caliband and Vari-Amp are Allis-Chalmers trademarks.

A-1164E

Editorial Comment

SEPTEMBER 28, 1959

Let's Try Some Hard Sell on Selling

Utilities are not measuring up to the challenge of boosting residential sales.

This opinion can evoke an argument by those who point to Edison Electric Institute's "Live Better Electrically" program and the efforts of individual utilities as evidence that the industry finally is heeding the warning that "The battle for our share of the consumer's dollar is going to get tougher."

We agree that LBE should aid the cause. And Electrical World has featured many of the programs of individual utilities that are aggressively battling for a larger share of the consumer's dollar.

Despite these plus signs, there is little evidence that the industry as a whole has awakened to the challenge of how to increase sales to residential customers. There is in fact, evidence indicating a preference persists for the status quo. Take, for instance, the Federal Power Commission figures for sales promotion expenses as a percent of total revenues. In the late thirties, Class A and B electric utilities spent from 2.2% to 2.5%. In the past decade—a period when the increase in average annual use of electricity has been tapering off—sales promotion spending has stayed right at 1.6% of total revenues each year.

Another case in point is reflected in Electrical World's revision of its long-term residential sales estimates. " . . . While we still expect to be serving the same number of new customers by 1975 as we predicted last year, it now appears the number of new all-electric customers will not grow as previously anticipated."

What is the conclusion? Electric utilities will have to match, or preferably exceed, the national sales promotion effort exemplified by the Live Better Electrically program. And to do this, utility sales promotion managers will have to do some hard selling of their own to convince management of the timeliness for something more than a status quo on the local front.

Update on the Co-ops' Finances

In the issue of May 18, we published an analysis of the Rural Electrification Administration's annual statistical report for the year 1957. It ran under the headline: "Do Co-ops Still Need Subsidies?" The exceptional state of financial health of the REA borrowers covered in the report led us to raise that question, and to express our strong opinion that they do not.

Now comes the REA's statistical report for the year 1958, which shows that the co-ops are making even more money than before.

Here are a few of the new figures:

- In 1958 the REA borrowers set aside 13.3% of their operating revenues as surplus. In 1957 the figure had been 13.1%.
- Total retained earnings of REA borrowers came to $98.71 per customer in 1958. In 1957 the figure had been $85.50.
- Earned surplus of REA borrowers passed the $450-million mark in 1958, with an increase over 1957 of 18.7%.
- The co-ops' "Investments and Special Funds" account increased by 27% in one year, rising to $244 million. In the five years since December 31, 1953 this account has grown by no less than 455%. At the end of last year it amounted to 7.5% of the REA borrowers' gross plant.

We believe these figures should get more attention than they are getting. They are another bit of evidence that the co-ops have become healthy enough to be operated on a business-like basis—without the taxpayers' help.

School Heating: Utilities Broaden S

The goal of acquainting a generation with electric heating advantages finds an upswing in installations during past two years and refinements in selling school boards and architects

Electric space heating—a concept regarded as a luxury item in most sections of the U. S.—is beginning to take hold in schools. And, to the obvious delight of electric utilities, the school progress is pegged to economy.

For the 49,477 school boards in the country this peg has become the main one on which building plans are hung today. Faced with a shortage of 140,000 classrooms already and a coming tide of new enrollments during the Sixties, school board members are a receptive audience for cost-cutting plans.

Those utilities already active in electric heating promotion are not neglecting this opportunity. An Electrical World survey shows that their promotion efforts are similar in technique and similar, too, in that broadened activities are under way or planned.

Although some utilities are no more than breaking even on school heating installations, they are convinced that youngsters will acquire the same appreciation for electric heating as home economics students gain for the energy when they cook with electric ranges.

The most popular method of convincing school board members that electric heating is not only economical but the most convenient as well is to let them see an installation and talk with teachers and principals who have lived with it.

Meeting, Tour Pay Off

Detroit Edison Co, for example, set up a dinner meeting at a new building in Utica earlier this year. State, county and local school superintendents, and government officials were invited. The reports by utility representatives, the architect, engineer, contractor and school superintendent were followed by a question and answer session and a tour of the building.

"It is expected this meeting will result in a large number of new school buildings being planned for electric heat in the very near future," says Alfred C. Sangster, Detroit Ed's space heating and air conditioning coordinator.

The company introduced school heating training sessions for its customer business representatives two years ago. In addition, meetings and direct mail folders keep architects and engineers updated.

American Electric Power Co's operating companies practice comparable methods. As James Hughes, Indiana-Michigan Electric Co's heating specialist, puts it: "We explain to school boards how use of electric heating can save dollars—maybe let them add a classroom free—instead of going into building details. Then we let them talk to school people who have electric heating."

Hughes touched on one of the main problems in this selling area: How to overcome some architects' resistance to change. In a cost comparison where electricity is selected as an alternate fuel, the building designed for fossil fuels often is not modified when considering the cost of electricity. Thus, added expenses for a boiler room fuel storage, pipe-tunnels, and smokestacks are factored into both estimates.

The approach Hughes aims for is to get electricity selected as the base fuel. It it's not he sells the school board on having separate designs for the conventional fuel and electricity.

Other problems have cropped up in the 228 school installations now on the lines or under construction in the U. S. (see box). Some contractors find, for instance, that the room units are ideal for drying plaster. Architects still lean toward distractingly large and hard-to-insulate windows. And electric heating salesmen find rugged opposition when a school board member turns out to be owner of the local gas, oil or coal company.

Washington Water Power Co places its emphasis on initial cost savings. When requested, the company makes a study and cost analysis of an individual school project, says H. U. Wright, sales heating consultant for WWP. The project is then worked out with the architect and engineer.

Wright discovered that general

Here Are Highlights of EEI Report on Schools

"Modern Schools Are Heated Electrically," a 20-page Edison Electric Institute report, underscores the impetus this area of selling has received in the past two years. By far the largest number of the 228 electrically heated schools listed were completed during 1958 and 1959.

Total connected load in the U. S. and in three Canadian schools is 55,608 kw. Biggest from the load standpoint is Penn Township High School in Mishawaka, Ind., where Indiana-Michigan Electric Co supplies the required 2,650 kw for the auditorium, swimming pool, music room, gym, cafeteria and 47 classrooms. Smallest is Cleveland Heights Board of Education's administration building's 1 kw of plug-in type equipment which Cleveland Electric Illuminating Co serves.

Washington leads the states in number of installations with 35 schools. Indiana is second with 33, followed by Ohio with 23 and Tennessee with 15.

The report, which was prepared by EEI's electric space heating and air conditioning committee, leads off with a two-page spread on electric heating's advantages and points out that electricity "can lend itself especially to the needs of today's school buildings—provided they are designed for electric heat." The booklet's publication number is 59-214; price, $1.25.

Sales Promotion Efforts

electric heat promotion, such as the forum WWP sponsors at Gonzaga University, can pay off. One of the engineers for the two WWP electrically heated schools said the company's 1958 forum inspired his proposal to the school boards for electric heat.

When school officials and planners told Georgia Power Co of their interest in overcoming conventional heating problems, the utility helped sponsor a four-day "go-see" trip for nine architects and engineers. The utility teamed with Lennox Industries, Inc, of Des Moines to take the group on a tour of Virginia Electric Power Co's Norfolk-Hampton area where two schools with heat pumps have been completed, one is being built, and two more are on the drawing boards.

Vepco cooperated by having school officials, architects and engineers on hand to evaluate the new systems. Then the party flew to the Lennox "living lab" school in Des Moines. Through an agreement with Lennox, the local board of education can have pupils attend the school on 24-hour notice so tests can be made. With heat pump and resistance heating under test, the visitors got a thorough look at the appearance and principles of the equipment.

While it's too soon to pinpoint results, both Georgia Power and Lennox feel certain the trip was worth the time, effort and the shared cost of $3,130. The first real interest is popping up in Fulton County, which is considering installation of a one or two-room experimental heat pump and resistance system in a school.

Aside from the tour, the utility holds occasional meetings with architects and engineers active in school design and construction, and also mails "Modern Schooling" and "Electric Heating and Cooling" to school superintendents.

Edwin L. Wiegand Co, makers of Chromalox heating equipment, is another manufacturer sparking utility school efforts. It has scheduled four workshops (see p 147) this fall for utility personnel. The Nov. 16-17 session will explore the commercial market, including schools. In addition, C. F. Kreiser, general sales manager, says the firm has tentative plans for a movie on electric heating for schools which utilities would be able to either buy or borrow for local showings.

At Puget Sound Power & Light Co an industrial service consultant in each county has been delegated to work with school boards and architects. In King County, next to Seattle, this move, and a new school rate instituted Jan. 1, has led to five all-electric schools out of eight proposed or placed under construction. The company plans to transcribe material from its mimeographed data sheets to slides for easier presentation to school boards.

Portland General Electric Co, while having no special promotional activity or material designed for schools, plans to install IBM instrumentation on the largest of four schools under way in its area. The IBM set-up will give a complete story on the 135-hp heat pump installation.

Specific Budget Planned

As with most companies contacted, Columbus & Southern Ohio Electric Co has no budget set up specifically for school heat promotion, but it is considering initiation of a planned program—with a specific budget—next year. The utility has three all-electric schools, one of which has a 1,950-kw connected load.

Other Ohio companies—Cleveland Electric Illuminating, Ohio Edison, and Cincinnati Gas & Electric—don't take close aim at the school heating market. Through contacts with architects and engineers, however, they pick up leads on interest in electricity for proposed buildings. Ohio Edison last week completed a brochure on a new Warren installation. Copies will be distributed at the school's open house and mailed to school boards considering building plans.

Commonwealth Edison Co also handles school jobs through an overall program, one which includes free school heating consulting advice or information upon request. In response to the feeling that it's too "plushy," the company stresses electricity's low first cost and labor savings in addition to cleanliness and convenience. In August CE held a week-long training session for its heat specialists who cover territorial divisions.

With the trend to 12-month use of schools, Pacific Gas & Electric Co finds an increase in heat pump applications where cooling is desired. Promotion material on general commercial space heating jobs is used for school contacts.

Plans are in the works for aggressive promotion of school heating by Alabama Power Co. Recent legislative approval of a $100-million bond issue for school construction is one factor in APC's interest. Another is the prospect of "radical changes in school architecture," which may result from studies by school authorities on more economical construction, says Walter Bouldin, Alabama Power president.

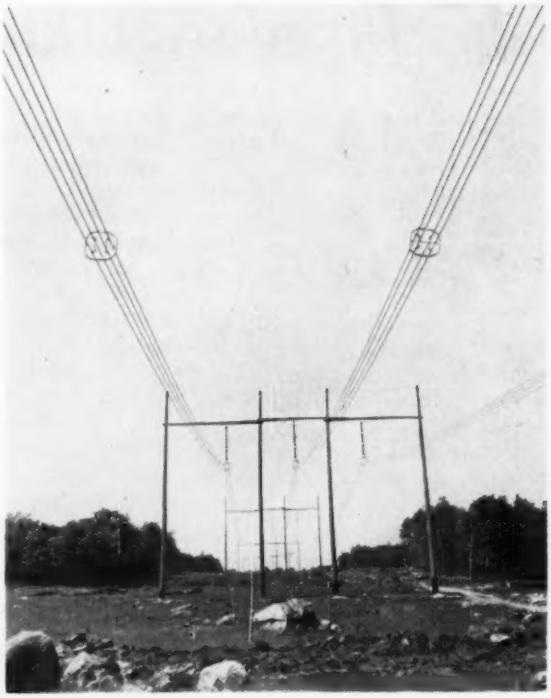
SESSIONS at Gonzaga U. for architects, engineers led to school jobs for WWP. B. Plowman, right, gives details

EXPANDING scope of booklets used in whole or in part on schools, illustrates emphasis placed on this load

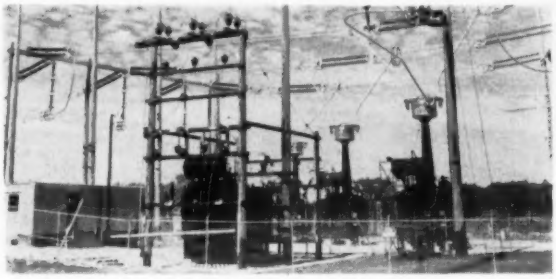
Test Finds Hardware Is Corona-Free to 600 Kv

The Coldwater Project, a major test of extra-high-voltage transmission by Ontario Hydro, has shown that the line's especially designed conductor hardware is essentially corona-free up to 600 kv. Overhead ground cables and other items of line hardware also are free of visual corona, report Ontario Hydro's research engineers who officially took over the project Aug. 12.

The Canadian power commission "is confident that the test results will be representative of the performance of actual line conductors," a recent announcement said. The tests include measurement of corona losses and radio interference. The one-mile lines will be operated at 500 kv for several months at first to age the conductors.



CORONA SHIELDS encircle bundled conductors. Line has two 2,500-ft sections in two directions from transformers



NERVE CENTER includes control room, left, terminal transformer to energize test line, single-phase test transformers

Ellis Sees 'Master Plan' as '3 P's in a Pod'

National Rural Electric Cooperative Assn General Manager Clyde T. Ellis has taken to the stump again this fall, addressing the Association's 10 regional meetings. His talks are mild in contrast to the bristling speeches he made last year.

Ellis' speech falls into three categories: (1) the need and essentials for creating a "model rural electric system," (2) a bludgeoning, free-swinging attack against the "master plan" to destroy REA, (3) co-op needs for the future.

The "ideal, or model co-op," he points out, "would provide the best possible service at the lowest possible cost, over the longest period of time, to all those served and to all the unserved in the area." Ellis then cites a lengthy list of good business practices for his NRECA members: written job specifications, fringe benefits program for employees, systematic wage and salary programs, safety training, power use programs, a "vigorous" member education and public information program, plus heavy reliance on NRECA's services.

'Three P's in a Pod'

The speech, however, drops from its lofty perch about half way through, when Ellis turns to the "master minds of the master plan" who are trying to "kill the rural electrification program," and "have now turned loose their sell-out techniques on both REA and NRECA." He calls the "anti-rural electrification campaign" a three-P's-in-a-pod affair, composed of:

"1. Power companies—attacking directly through ads in the mass magazines, through lobbying, and by pirating our service areas;

"2. Propagandists — apparently well financed pamphleteers and scandal-mongers, and a few unscrupulous columnists and editors, barraging the United States with the profit power company line;

"3. Politicians—certain top Administration officials and a very few members of Congress, bombarding the program with radical speeches, using the same truths, half-truths, untruths and innuendos as the power companies and their propagandists."

Ellis particularly picks on Reps Bruce Alger (R-Tex.) and Ancher Nelson (R-Minn.).

He lists, in order, the four most important areas of Congressional legislation as: (1) maintaining REA loan-making powers. (2) maintaining the present 2% interest rate on REA loans, (3) safeguarding the federal wholesale power supply for co-ops, (4) creation of a federal atomic energy program "to allow the government to construct enough atomic plants for wholesale power development."

Internal Revenue Service Revises Ad Rule

Power company officials say the new wording on what is deductible is stricter; new rule is retroactive to 1954

The Internal Revenue Service finally "dropped the other shoe" last week, issuing its long-awaited revised regulation defining tax-exempt advertising contributions. The new rule, according to utility officials in Washington, seems to be a stricter regulation of what's deductible in advertising.

Nevertheless, power company officials are sticking by their disagreement with the IRS interpretation which specifies how the rule is to be applied to given advertisements. The complaint was lodged back in mid-1956 when the first version of Section 162 of the Internal Revenue Code was proposed. The issue was the application of the regulation to the tax-accountability of a three-year series of the Electric Companies Advertising Program (ECAP) ads.

Under that ruling, IRS found that ECAP ads could not be classified as tax-deductible ordinary business expenses, but should be considered as "political" in nature—to be accounted for "below the line" after taxes are deducted.

Utility leaders, through the Reid & Priest law firm, are still righting the IRS interpretation of the ruling —an interpretation which is binding under either the proposed regulation or the one finally issued.

Reid & Priest has submitted a brief to IRS outlining the companies' position, but a meeting between power utility leaders and IRS chief Dana Latham still has not been held.

New Rule More Definitive

The new IRS regulation (1.162-15) defines more fully the contributions that may be deducted from income taxes, and it is retroactive to any taxable year starting after Dec. 31, 1953, or ending after Aug. 16, 1954. Written comments or requests for a hearing will be accepted by IRS for 30 days. Portions of the new rule are as follows:

"Expenditures for lobbying purposes for the promotion or defeat of legislation, for political campaign purposes (including the support of or opposition to any candidate for public office), or for carrying on propaganda (including advertising) related to any of the foregoing purposes are not deductible from gross income. For example, the cost of advertising to promote or defeat legislation or to influence the public with respect to the desirability or undesirability of proposed legislation is not deductable as a business expense, even though the legislation may directly affect the taxpayer's business. On the other hand, expenditures for institutional or 'good will' advertising which keeps the taxpayer's name before the public are generally deductible as ordinary and necessary business expenses, provided the expenditures are related to the patronage the taxpayer might reasonably expect in the future . . .

"In like fashion, expenditures for advertising which present views on economic, financial, social, or other subjects of a general nature but which do not involve any of the activities specified in the first sentence of this subparagraph are deductible if they otherwise meet the requirements of the regulations under Section 162 . . .

"Expenditures for the promotion or the defeat of legislation include but shall not be limited to, expenditures for the purpose of attempting to—

'Influence' Aspect Spelled Out

"(I) Influence members of a legislative body directly or indirectly, by urging or encouraging the public to contact such members for the purpose of proposing, supporting or opposing legislation, or

"(II) Influence the public to approve or reject a measure in a referendum, initiative, vote on a constitutional amendment or similar procedure."

Injunction Filed in Strike at PSE&G

A U. S. District Court judge handed down a temporary injunction Sept. 18 requiring a boilermakers' local to "show cause" by Sept. 24 or else desist from picketing plants of the Public Service Electric & Gas Co.

The walkout began early this month as a union protest against a number of contractors working at Public Service's Bergen, Mercer and Linden generating plants. Picket lines blocked operating personnel but supervisors manned the stations. There has been "no loss of capacity," the company said.

PSE&G filed a secondary boycott complaint before the National Labor Relations Board soon after the strike started. The NLRB then brought the case to the federal court.

Construction at the Bergen and Mercer stations has been slowed by the walkout. The second Bergen unit, scheduled to go on the line late in 1959, was delayed 39 days by a strike earlier this year. Mercer's first unit is scheduled for 1960 operation. The boilermakers' walkout at Linden involved only three maintenance men working for the boiler contractor.

The nearly 300 strikers are members of Local 28, International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers, AFL-CIO.

Oregon Rate of 1.27¢/Kwhr Is Half the U. S. Average

Electric consumers of Oregon pay an average of 1.27¢/kwhr, exactly one half the national average, according to Oregon Public Utilities Commission.

Average residential use is 8,279 kwhr. Private power companies supply 84% of the Oregon consumers.

Powerscope

BWR Gets AEC Vote

A small boiling water reactor is the second project which the Atomic Energy Commission will propose for joint construction with municipal or cooperative systems under legislation passed this year.

Dr David Cope, reactor division director of AEC's Oak Ridge operations office—which will have responsibility for the small nuclear plant program—has explained that AEC requirements to prove feasibility of small nuclear plant operating costs meshed with results of a co-op questionnaire for the BWR. But dates weren't given on when another proposal would be issued and definite specifications set.

On the basis of Oak Ridge studies, "pressurized water, boiling water and organic moderated concepts looked most promising for AEC requirements, and [are] about the only ones that would fit," Cope told a meeting in Washington, D. C., sponsored by American Public Power Assn and the National Rural Electric Cooperative Assn.

A questionnaire showed peaking requirement trends of 16.5 and 22 emw, with a future need for 22 emw plants materializing for the 400 systems.

Tax Facts

Northern States Power Co has just put out to its customers a small four-page folder "NSP & Taxes" that provides a quick picture of the company's largest single operating expense. With a reminder that high-level taxes "have the power to destroy a business or an industry if that business or industry must compete with tax-free or tax-subsidized competition," NSP adds these items:

- NSP taxes ($38.7 million in 1958) are nearly 2½ times as great as the combined taxes of all 1,030 REA cooperatives in the U. S., while REA gross revenues are about 3½ times as large as NSP's.
- NSP taxes are nearly 7.3 times as great as the taxes of TVA, although NSP revenue is only 66% of TVA's revenue.
- On a basis of taxes per customer, NSP pays $45 per customer, as against $3.52 by TVA and $3.43 by REA.
- NSP taxes per share of common stock are more than double the company's earnings per share, and close to three times the dividends per share, based on 1958 figures.

High Parameters

Blueprints for a back-pressure steam turbine of 100-Mw rated capacity are ready for a U.S.S.R. plant at Charkov, Ukrainia, according to Tass. The turbine, the first of such high parameters for the Soviets, is to operate on steam of 4,266 psi at 650 C.

$ Sharing Takes Hold

Forty-eight South Carolina communities have signed contracts for a Duke Power Co plan that substitutes a percentage of the company's gross revenue in each town for the privilege license tax.

All other taxes are paid on the same basis as in the past. The contract does require that Duke provide energy for street lighting and other municipal uses. The payment scale is 3% of the first $100,000 gross revenue on residential and commercial sales; 2% of the next $400,000; 1% of all over $500,000.

In Lancaster this means annual payments to the city of $8,300 instead of the previous $1,100.

Carolina Power & Light Co and South Carolina Electric & Gas Co have offered similar plans in the state. The increased outlay of the firms may be offset by a reduction in state taxes, if such legislation is passed by the state's lawmakers.

A New Muni System

The electric distribution system at Richland, Wash., headquarters for the Atomic Energy Commission's Hanford Works, will become the state's third largest municipal system this fall. The system, which has about 7,000 residential and 260 commercial customers, is owned by the federal government and operated by General Electric Co. Energy source is the Bonneville Power Adm.

Loren H. Holden, GE superintendent of the system, will assume the same title for the city's electrical department when the change occurs.

The transfer to city ownership traces back to legislation passed by Congress for disposal of Richland and Oak Ridge, Tenn., properties.

One-third of Richland's residential customers use electric heat; all but 500 have electric water heating. About 922 homes in the city have 200 amp systems. Average use per residential customer was 11,500 kwhr in 1958. Average residential rate last year was 0.98¢ per kwhr.

Insurance Groundwork

Fifteen Wisconsin electric cooperatives have organized an insurance company which they hope will cut policy costs on workmen's compensation. At the same time the new group—Federated Rural Electric Insurance Corp—"can lay a groundwork that holds vast promise in the entire field of finance," says W. V. Thomas, manager of the company.

Federated can expand into other states, Thomas says, after one year of Wisconsin operation. The nonprofit firm is owned by the member co-ops which will receive any savings that accrue. Nationwide Insurance, a large U. S. cooperative, will reinsure Federated's policies under the new setup.

Bechtel Adds to Agua Fria

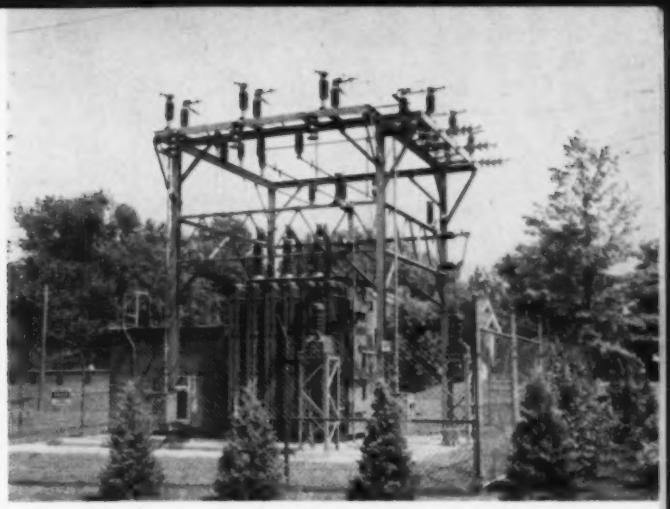
Construction of Unit #3 of Salt River Project's Agua Fria station is scheduled to get underway Oct. 1 with the Los Angeles office of Bechtel Corporation in charge. Allison Steel Manufacturing Co of Phoenix, Ariz., will supply the structural steel.

Purchase orders for 60% of the equipment required for the $22 million project have been issued, including the 168,000-kw generator to be supplied by General Electric Co. Switchgear and power transformers for the addition amount to some $142,000.

When this addition goes into service, probably in May 1961, the Agua Fria site near Glendale, Ariz., will have an installed capacity of 395,000 kw with an investment of more than $45 million.

Substation Changes Reduce Costs

Motor-operated disconnects on 34-kv side help streamline Union Electric substation operations, uprate substation capacities



MOTOR-OPERATED DISCONNECTS on 34.5-kv side permit elimination of low-side breakers. Replacement of old breakers effected substantial cuts in maintenance costs

JOHN L. NOLTE, Substation Engineer, Union Electric Co, St. Louis, Mo.

By changing substation design Union Electric Co reduced operating costs and uprated substation capacities. In the new design, motor-operated disconnects on the 34-kv side replace air circuit breakers on the 4.16 or 12.47-kv side. Breakers at the 34-kv source protect transformers and low-voltage buses against faults. Known as the "high-voltage selective" switching scheme, this design was developed since 1946.

Until 1957, the basic arrangement was the low-voltage selective scheme, including outdoor metal-clad switch gear with single main buses. Power transformers were 3-phase, equipped for load-tap changing, rated 3 to 10/12.5 Mva. The subtransmission system feeding them was 34.5 kv, grounded through transformer neutral reactors at the source; distribution voltages were 4.16 and 12.47 kv, solidly grounded.

Initial substation design called for the single-transformer, radial type. Either a breaker or a dummy breaker element was installed in the transformer's low side. As loads grew denser, second and third units were installed along with 34.5-kv supply and low-side bus tie breakers and controls to convert the substation to low-voltage selective type design. With three units and three 34.5-kv supply circuits, this arrangement needed five low-side circuit breakers. The 34.5-kv tie disconnect switches and the low-side tie breakers were normally open. Upon loss of voltage at either bus, the tie breakers closed automatically, and reopened when voltage was restored.

In the next development of the single-unit design, a second 34.5-kv supply source improved service reliability. The two 34.5-kv supplies were put on the preferred-emergency basis, motor-operated mechanisms operating the 34.5-kv disconnect switches. The preferred-line disconnect was normally closed; the reserve line one normally open. This change in design dates from 1954.

Basic Design Changed

In 1957, the basic substation design became the high-voltage selective scheme. In the single-unit substation, the change constituted only replacement of the transformer low-side breaker with a load-break disconnect switch. As before, the two 34.5-kv supplies are controlled on an emergency-preferred basis. With two and three transformers, motor-operated bus tie disconnect switches will be applied on the 34.5-kv side and manually operated bus tie disconnect switches on the low-side.

With one transformer and two 34.5-kv supply sources on the preferred-emergency basis, potential indication is fed to the control from both a single-phase, high-side potential transformer on each incoming line and the three low-side potential transformers. Control features are:

1. Loss of potential on the preferred line, as indicated by the high-side potential transformer on that line, opens, after a time delay, the switch on the preferred line and closes that on the reserve line, if the latter has potential. The delay is set to permit one reclosure of the supply at the source to avoid unnecessary transferring at the substation.

2. Return of potential on the preferred line, after a time delay, closes the preferred line switch and opens the reserve line switch.

3. Loss of one or two phases of potential, as indicated by the low-side potential transformers, initiates a transfer to the reserve supply and locks out return until it is manually reset. This is necessary to avoid a switch pumping action. Use of the low-side potential transformers for indication of a single-phasing condition eliminates the need for 3-phase indication on the high side, resulting in appreciable savings.

4. A switch allows selection of line as the preferred source.

5. Power for motor-operating mechanisms is from the "hot" line potential transformer or station battery.

When a second transformer with high and low-side bus tie disconnect switches is added minor control changes will give automatic "high-voltage selective" operation. These include installation of a set of voltage relays on the second unit's low-side potential transformer and a high-side bus tie control switch, and removal of the line-preference switch. With these controls, if

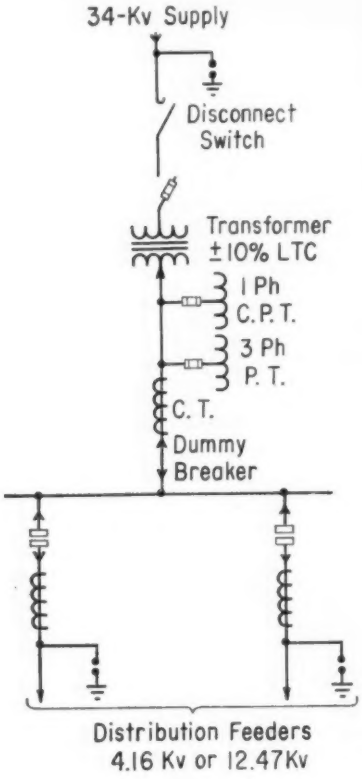


FIG 1—**SINGLE-UNIT,** single-supply design had a breaker in the low side

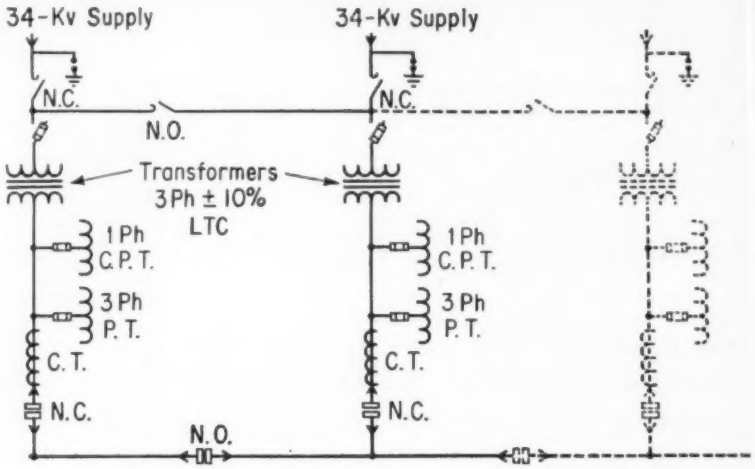


FIG 2—**INITIAL DESIGN** for two or three-unit sub has "low-voltage selective" scheme with breakers on low-voltage side of transformers and the bus ties

potential is lost on either incoming line, its switch opens, after a time delay, and the bus tie closes. When potential is returned, the line switch and the bus tie switch close. If potential is lost on one or two phases of either incoming line, that line's switch opens and the bus tie switch closes and locks. The bus tie switch does not return to the open position until it has been reset manually. If the substation has a total outage, both transformers are returned to the first line re-energized.

Union Electric protects transformers up to 5/6.25-Mva capacity with fuses. When 10/12.5-Mva sizes were required, there was a problem of getting source protection sensitive enough to guard 34.5-kv lines from burndown and coordinate with the larger fuses at the substations.

In the solution of this problem, negative phase-sequence, time-overcurrent relays are being installed on the 34.5-kv feeders, along with the standard phase and ground overcurrent relays. In addition to providing better 34.5-kv line protection, these relays permit elimination of the high-side fuses on 10/12.5-Mva transformers.

One disadvantage of this arrangement is that in event of a transformer failure all load connected to the feeder is interrupted. But this is not serious because of the reliability of today's transformers. If a transformer fails, it is cleared from its feeder by the overcurrent relays connected to the transformer high-side bushing current transformers. These overcurrent relays are then added to the high-voltage selective switching control. Operation of an overcurrent relay, which indicates a transformer or low-side bus fault, causes the incoming line switch to open, after a time delay, and lock out the closing of all other switches. The time delay is coordinated with

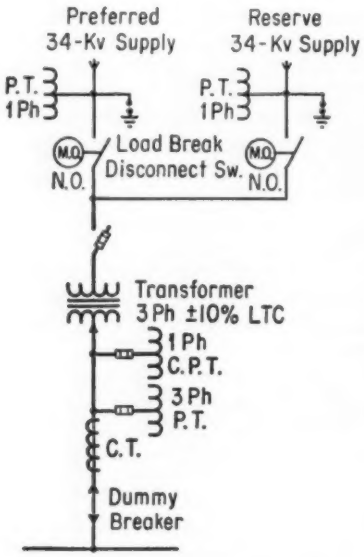


FIG 3—**SECOND SUPPLY** improved reliability, was step toward new scheme

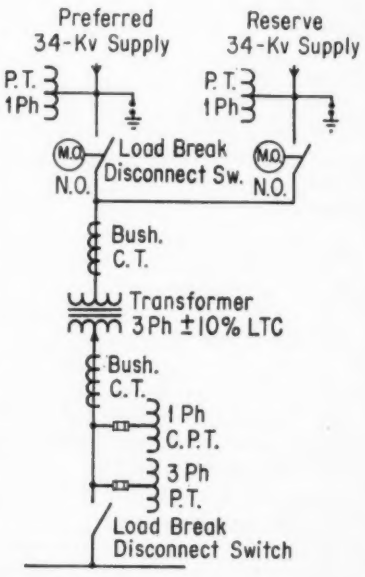


FIG 4—**LOAD-BREAK** disconnect switch replaced breaker in low-voltage side

the source feeder breaker so that the incoming line switch does not open when there is fault current flowing.

Recent substation installations included load-break attachments on the 34.5-kv disconnect switches. These permit the switch to interrupt circulating current between two sources of supply after they have been tied together during a switching operation. If the switch must open on a single-phasing condition, it can break full-load current on the remaining phases.

Potential indication on the 34.5-kv side has normally been obtained from one standard, unfused, single-bushing potential transformer per incoming line. Voltage dividers were installed recently at one location to obtain potential indication. It costs only about half as much as the PT. Success of the scheme depends upon finding reliable low-burden voltage relays. Low-side potential indication is from the standard potential transformers for station metering.

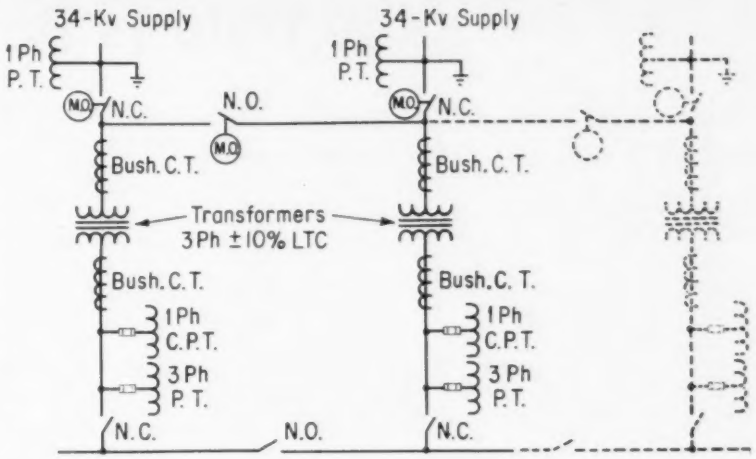


FIG 5—HIGH-VOLTAGE SELECTIVE SCHEME for two or three-unit substation replaces breakers on low side and bus tie breakers with disconnect switches

Based on ASA Guide

Accepted substation ratings with the low-voltage selective scheme are:

1. Nameplate capacity for the single-transformer substation.

2. For a substation with two or more transformers the capacity is the emergency rating of the transformer or transformers in service when the largest transformer is out. This rating is based on the ASA loading guide. For example, with two 10/12.5-Mva OA/FA units in service, the accepted substation rating is probably about 17.5 Mva, depending on the loading cycle. With three 10/12.5-Mva OA/FA units, the rating is about 35 Mva.

Outages Not Excessive

With the high-voltage selective scheme, the accepted rating for a single-transformer substation is the transformer nameplate capacity. With a two-transformer substation it is equal to the self-cooled rating of both units. For two 10/12.5-Mva OA/FA units, the accepted rating is 20 Mva, or 2.5 Mva higher than that of the low-voltage selective scheme. With adequate feeder ties to adjacent substations this rating can be increased by several Mva.

The philosophy behind the higher rating with the high-voltage selective scheme is that the loss of a 34.5-kv feeder does not automatically throw all the station load on one transformer but keeps both units in service and performs the switching to feed these transformers from the remaining 34.5-kv feeder. While this gets away from the firm-rating principle, it appears to be justified on the basis of the system's transformer and 34.5-kv feeder out-

(*Continued on page* 67)

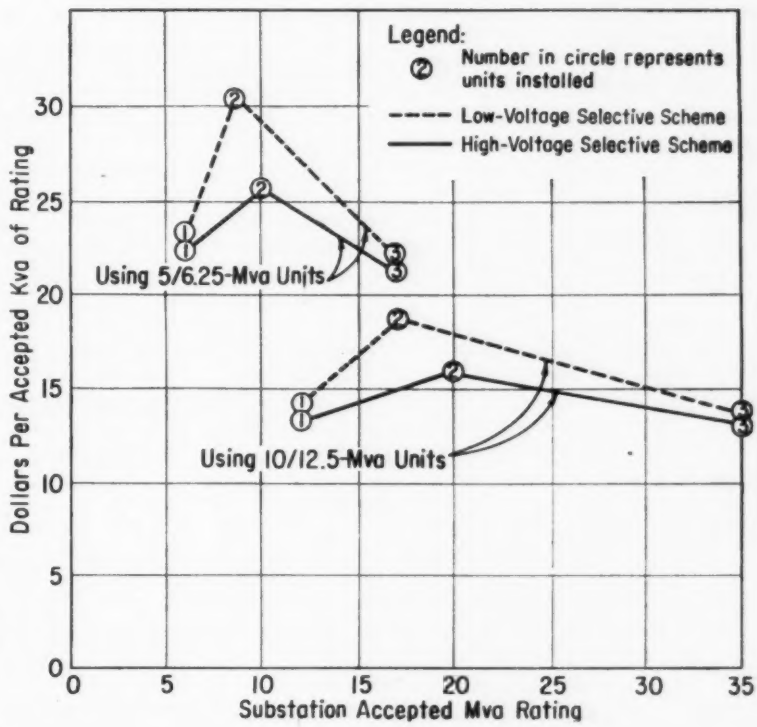


FIG 6—GRAPH shows permissible ratings are increased in high-voltage selective scheme, which cuts investment, including site, for a wide range of ratings

Why Italy Is Building Nuclear

Only A-plants can supply growing loads as hydro sources wane, fuels remain scarce

DR BRUNO BIANCHI, Engineer, Vice-President, Societa Elettronucleare Nazionale (SENN), Rome, Italy

Hydraulic resources have been utilized up to now, to the maximum in satisfying the demand for electric power in Italy where fuels are scarce.

Steam plants have the traditional role of supplementing hydroelectric plants, especially during the winter dry seasons and for meeting seasonal, weekly, and daily load peaks.

The hydraulic resources which had been estimated to have a useful potential of 45 to 50 billion kwhr per year, have more recently been estimated to be 50 to 60 billion kwhr per year. But even if the Italians were to assume that with new technical developments these figures might be higher, they would find themselves very soon in the position where the greatest power source in the country would be exhausted.

The harnessing or geothermal steam has made available an additional 2 billion kwhr of electric power each year.

Fuel Resources Limited

Nevertheless, in view of the proved scarcity of solid fossil fuels and the limited resources of methane and oil deposits, the margin for expansion based on the utilization of Italian subsoil resources does not seem to be very great.

The report submitted by the Italian representative to the Geneva Atomic Conference estimated that the electric power demand in Italy would amount to about 64 billion kwhr a year by 1965 and to approximately 96 billion kwhr a year by 1975. These are considered to be low estimates.

It has been pointed out that these estimates are overly conservative; they are based on growth rates substantially below those actually encountered during the past ten years.

New figures must therefore be regarded as minimal and to be taken together with other factors in order to reflect a growth rate comparable to that of the past ten years and closely follow the so-called quasi Aillerst Law, in which the electrical energy figure is doubled every ten years.

Thus, by 1965 the power needs would be of the order of 75 million kwhr per year, and by 1975 approximately 150 billion kwhr per year (high estimates).

Energy Deficit Possible by 1975

If we take these last figures, which are more realistic than the first ones, it is probable that by 1975 Italy's electric power requirements will be satisfied with not less than 50 billion kwhr per year from hydroelectric plants, 2 billion kwhr per year from geothermal sources, and 5 billion kwhr per year from steam plants using domestic fuels, leaving a deficit of about 93 billion kwhr a year.

This deficit would have to be supplied from steam power plants using imported fuels, or else by resorting to nuclear power, an entirely new source of electrical energy.

Actually, the country's economy could not bear the importation of solid and liquid fuels from abroad for the purpose of meeting an annual demand of the order of 93 billion kwhr. Not only would this demand constitute a continued, tremendous drain on funds, but dependence on crude oil from the strategically vulnerable Middle East can hardly be considered conducive to a healthy political situation. Thus, the Italian utilities, which have almost exhausted their traditional source of power, have shown a very close and deep interest in everything relating to commercial nuclear power applications since the first nuclear discoveries and have taken upon themselves the heavy burden of building the first pilot nuclear power plants

Italian Nuclear Power Plants

Plant	Site	Reactor Type	Thermal Power	Electrical Output (Net)	Fuel
SENN	Near Naples	BWR	507,800 kw	150,000 kw	Slightly enriched UO_2 pellets—canned in Zr tubes
SELNI	Milan	PWR	615,000 kw	160,000 kw	Enriched UO_2 pellets in stainless steel tubes
AGIP	Not Selected	Not Selected	.....	200,000 kw	.....
SIMEA	Near Rome	Graphite Moderated Gas-cooled	.....	200,000 kw	Natural uranium, rod, magnox

in order to obtain experience for all of their future development programs.

It is obvious that Italy cannot evade its obligation to exert every possible effort in the field of pure and applied research so that within the shortest period of time, it may be possible to achieve maximum progress in the construction and operation of nuclear power plants that will render the cost of this new power source competitive with that of traditional power sources.

In the light of these considerations, it is no wonder that Italy really appears as the most courageous and decisive of the European common-market countries in setting out on the road of commercial nuclear research and development.

Four Companies Will Build Plants

At present, the Italian companies which intend to build nuclear power plants are as follows: SENN (Società Elettronucleare Nazionale), which consists of organizations in which the Italian Government is a shareholder (the IRI Group) as well as independent companies, and which has been named by the Italian Government to carry out the so-called ENSI (South Italy Nuclear Energy) project; SIMEA (South Italy Atomic Energy Company) and AGIP NUCLEARE, which are controlled by ENI (National Hydrocarbon Administration); and SELNI (Italian Nuclear Electric Power Co), which is controlled by Edison.

Such fervent Italian activity in the nuclear field has aroused a good deal of international interest. This is particularly evidenced by the specific cooperation that has been given to one of the aforementioned nuclear power projects (namely, the SENN project) by the International Bank for Reconstruction & Development (IBRD).

The IBRD has agreed to furnish its cooperation because, in the words of Eugene R. Black, its president, "Italy, where conventional fuel costs are relatively high while its demands for power are increasing, may be regarded as one of the countries most likely to make use of atomic energy on a commercial scale in the near future."

The EURATOM-USEAC agreement, which calls for the building in Europe of a certain number of industrial research reactors with an installed capacity of approximately 1 million kw, promises broad and challenging new horizons for the entire nuclear industry in Italy.

The possibilities of obtaining financing at suitable interest rates, fuel guarantees, and technical assistance for reseach and test reactors undoubtedly constitute an incentive.

Rapid Obsolescence Likely

Since the technical changes on the first models of nuclear power plants now regarded as really typical are being made so fast, it is reasonable to anticipate that they will become obsolete within relatively short periods of time. This naturally calls for an accurate and critical examination of all data relative to amortization which must be assumed on the basis of the more or less carefully-weighed nuclear cost calculations per kwhr.

It is therefore to be expected that these pioneers shall receive the assistance of the Italian Government, which will reimburse them for the inevitable losses they will sustain, as well as all such international cooperation as can possibly be obtained.

Cost Differences Must Be Covered

Furthermore, following the example of other countries where the greatest nuclear progress has been made (the United States and England), provisions must be made for those government-industry projects to cover the inevitable difference in cost between a kwhr produced in steam power plants and that produced in nuclear power plants being constructed. Germany is already drafting legislation in this connection.

A cautious, conservative, and yet hopeful, assessment of all the difficulties that will confront Italy along the hard road of industrial nuclear research leads us to the conclusion that this cost difference, however large or small, cannot be eliminated at a very early date.

In short, we must not abandon these pioneers who are entrusted with the future of our new nuclear economy.

DR BRUNO BIANCHI

Bruno Bianchi, Dr-Engineer and vice-president of Societa Elettronucleare Nazionale, is general director of Societa Romana di Elettricita and managing director of Societa Finanziaria Elettrica Nazionale. No stranger to Europe's capitals nor to the United States, he is the author of scientific papers, mostly on agricultural and industrial uses of electricity. A member of important industrial societies, his counsel is sought on financial, management, engineering, and nuclear power matters, especially. Born in Perugia in 1901, he was a graduate engineer at 21. He has devoted his professional life to Italy's electrical industry, in which he is today the prime promoter of the use of the atom for the generation of Italian electric power. He writes as an authority on Italy's present-day electrical problems

Rewinding Transformers May Be

Cost evaluation reveals that many transformers that are as much as 33 years old can be rewound economically

Table I—Losses in Best Grade Transformer Core Steel Commercially Available in U. S.

Year	Hot Rolled Core Steel Watts/lb at 64,500 Lines/sq in.	Watts/lb at 80,000 Lines/sq in.	Year	Cold Rolled Core Steel Watts/lb at 75,000 Lines/sq in.	Watts/lb at 97,000 Lines/sq in.
1903–1908	1.8	2.8	1936	0.59	1.0
1909–1923	0.8	1.24	1938	0.53	0.9
1924	0.77	1.19	1939	0.47	0.8
1926	0.72	1.11	1950	0.43	0.73
1930	0.66	1.02	1954	0.39	0.66
1932	0.64	0.99			
1934	0.58	0.90			
1937	0.52	0.81			

Note: Only minor improvements were made in hot rolled steel after 1937. Limitations in hot rolled steel exciting current led to development of cold rolled steel.

Table III—Losses in Rewound Transformers

24 Kva, 7200-12/240-v, Single-phase, 60 cyc.

	1921 to 1926	1927 to 1930	1931 to 1934	1935 to 1938	1939 to 1942	1943 to 1946	1947 to 1950	1951 to 1954	1955 to 1958	1959 Guarantee
Core Loss	216	179	183	158	152	140	138	132	125	128
Copper Loss	430	404	490	430	434	412	408	401	383	378
Exciting Amp	4.44	4.50	2.78	4.14	32.8	2.33	2.21	1.97	2.05	1.56
% Impedance	2.58	2.59	3.45	3.01	3.64	2.98	2.90	2.67	2.85	2.0
No. Units	24	49	4	37	76	80	149	35	9	...

Table IV—Cost of New Transformer Compared with 1921-26 Rewound Unit

	New 25 Kva		1921—26 rewind	
Annual Cost of Core Loss	.128 kw x $22.00	= $2.82	.216 x $22.00	= $4.32
	.128 kw x 8,760 x .0045	= 5.05	.216 x 8,760 x .0045	= 8.42
Investment Annual Charge	$364.00 x .15	= 54.60	204 x .15	= 30.60
Annual Cost of Copper Loss	.378 x $22.00	= 8.32	.430 x $22.00	= 9.45
	.378 x 8,760 x .0045 x .38	= 5.66	.430 x 8,760 x .0045 x .38	= 6.44
Annual Cost of Exciting Amps	1.2 x 240 = 288 va		4.44 x 240 = 1.056 Kva	
	$7.00 x .15 x .288	= 0.30	7.00 x .15 x 1.056	= 1.11
Evaluated Life Expectancy—Annual Cost of Failures		0.16		0.32
Extreme Annual Cost of Regulation		....		2.00
		$76.91		$62.66

Economical

JOHN O. FENWICK, Electrical Engineer, Daley Electric Co, Phoenix, Ariz.

Rewinding transformers as much as 33 years old may prove worth while if the tanks are in good condition. Steel tank transformers in 25 to 100-kva sizes can generally be rewound economically.

Type of tank is a determining factor in deciding whether transformers are worth rewinding. Cast iron tanks were common until about 1926. It seems logical to thus recommend junking any transformer made prior to 1926, which also eliminates older core steels in which core loss increases with age.

In evaluating losses and annual costs, a figure of 15% for annual fixed charges is used. This includes interest, depreciation, taxes, dividends, etc. Fuel cost is estimated at 4½ mills and fixed generation charges for losses are figured at $22.00 per kw per year.

Load factor is figured at 50%, and copper losses vary as the square of the load. The load factor squared is 25%. For evaluating copper loss, we assume a factor half way between 50% and 25% or 38%.

Evaluate Capacitor Cost

The only fair way to evaluate exciting current is to evaluate the cost of capacitors required to neutralize the exciting current. One figure in use is $7.00 per kva for installed capacitors.

Life expectancy is often a major question in rewinding transformers, but one large transformer user experienced a 1958 failure rate of ½% for rewinds and ¼% for all other transformers. A charge of $57.24 is made to change out a transformer. A new 25-kva transformer costs $364.00, making the installed cost $421.24. Using 15% per year for fixed charges, the annual cost is $63.19 per replacement transformer. At a ½% failure rate for rewinds, this totals $0.32 per year per transformer. For a new transformer it would be $0.16 per year per transformer.

Voltage regulation can also be evaluated. The highest impedance for a 25-kva rewind from Table IV is 3.64%. Per cent IR drop is 1.7% and the percent IX drop is 3.2%. One user assumes 75% power factor, 40% load factor and 4 mills profit per kwhr. He assumes that motor load is constant with varying voltage and resistance load varies as the 1.6 power of the voltage. He also assumes that motor load is about double the resistance load in the average home.

New transformer regulation at 75% P.F. is 2.0% and regulation on a transformer with 3.64% impedance is 3.4%. Using 120 v as normal, 2% regulation gives 117.6 delivered and 3.4% regulation gives 115.92.

Annual kwhr delivered by a 25-kva transformer at 75% P.F. and 40% load factor is 65,700 kwhr. Resistance load at ⅓ makes 21,900 kwhr. The increase in kwhr consumption due to the use of new transformers would be 21,900 kwhr $\times \left(\frac{117.6}{115.92}\right)^{1.6} - 21{,}900 = 500$ kwhr. A 4-mill profit per kwhr $\times$ 500 kwhr equals two dollars per year. This would be an extreme case, as most rewinds have impedances much lower than 3.64%.

Extra copper loss caused by the exciting current flowing in the primary winding can be evaluated, but it is so small that it can be neglected. Extra losses in feeders caused by exciting current are also small.

The controlling factor in the annual cost comparison is investment cost and not cost of losses or exciting current.

Rewinding transformers has been stepped up because of voltage system changes. Rewinding 2,400-v transformers to 7,200 v is often under consideration. This should only be done where tanks are good and clearances are adequate for 15-kv insulation. Considerable savings are possible because of the surplus of 2,400-v transformers. Average test data for this type of conversion are shown in Table VI.

Rewinds Show Savings

These transformers show substantial savings when compared with new transformers. In changing from 2,400-v to 7,200-v less turns are used in the 240-v winding, thereby raising flux density in the core and increasing core loss. This gain in winding space, plus improvement in space factor by using the latest materials permits use of 15-kv class insulation instead of 5 kv. Copper density is also higher, resulting in increased copper losses. However, 7,200-v transformer losses are normally higher than 2,400-v transformer losses and rewound units show substantial annual savings when compared with new units.

In converting 2,400-v units to 7,200 v, tank modifications are often needed. A well-equipped repair shop can change tanks from pocket bushings to cover bushings and install ASA standard mounting brackets where needed.

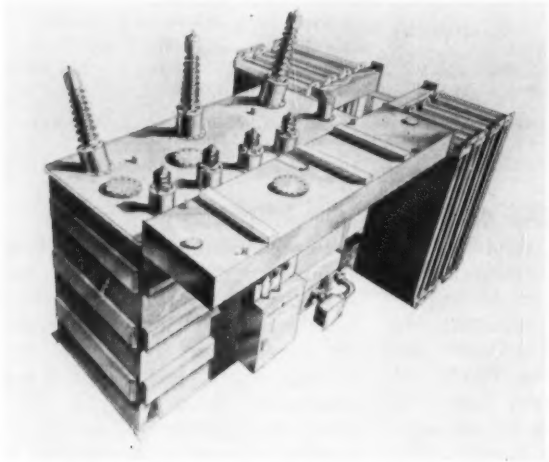
Table II—Costs of New Transformers and Rewound Units

7,200–120/240-v, single-phase, 60-cycle, standard distribution transformers with 4-2½% taps and 2 H.V. cover bushings

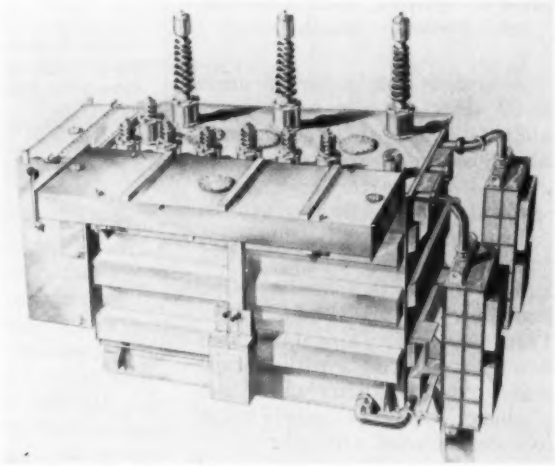
	15 Kva	25 Kva	50 Kva
Western Price New	$264.00	$364.00	$579.00
Rewind Price	149.00	304.00	324.00
Rewind Plus New Tanks	206.00	270.00	425.00

Table V—Annual Losses in Units Converted from 2,400-v to 7,200-v

	15 Kva	25 Kva	50 Kva
Core Loss, w	97	147	218
Copper Loss, w	280	420	750
Exciting Amps at 240 v	1.62	2.80	3.52
% Impedance	3.15	3.20	3.36
No. units	233	268	38



LARGE SUBSTATION TRANSFORMER, rated 12,000 to 50,000 kva, 69 to 161 kv, with or without load-tap changing equipment, employing the Preferred Design concept



TRANSMISSION TIE AUTOTRANSFORMER, rated 24,000 to 75,000 kva, 115 to 161 kv, with or without load-tap changing equipment, employing the Preferred Design concept

GE Extends 'Preferred Design' Concept to L

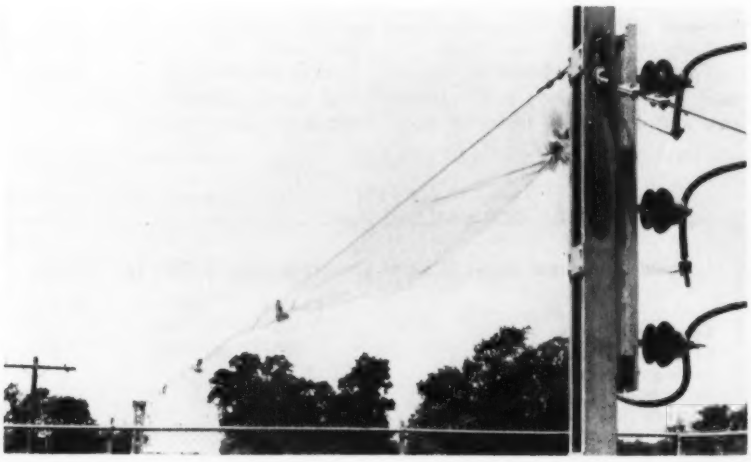
Another forward step was taken this week by the electrical industry in its long-range drive against inflation when General Electric announced a sweeping redesign of its large power transformer line.

"Ever-rising labor and material costs" are cited by GE as the reason behind the transformer redesign, but there is also indication that the move is part of a more aggressive sales and engineering policy to meet rising domestic and foreign competition.

The new line extends the Preferred Design concept introduced in 1957 to transformers rated from 12 to 250 Mva and 230 kv.

GE looks to its transformer redesign program as a means of keeping power transformer price levels stable in the face of the inflationary rise in material and labor costs. Announcement of the program was accompanied by a 5% average net published price reduction for the entire line, with savings from the new design amounting to 20% for larger ratings.

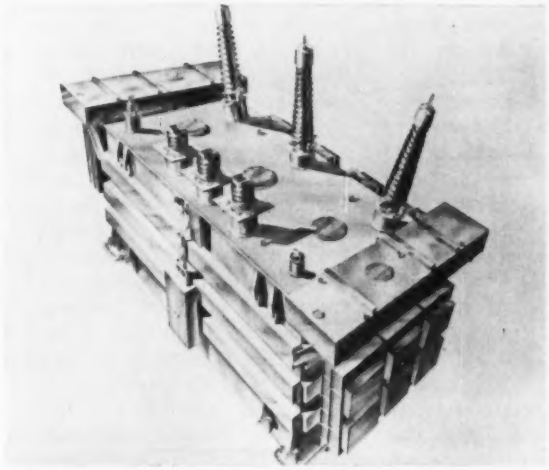
The Preferred Design concept is centered around a basic transformer unit that includes tank, core, and windings, to which any of three types of cooling can be added as an accessory, depending on the customer's needs and preferences. These are: 1) FOA, 2)



Roebling Makes S

A dramatic movie of short-circuit tests on the Roeclamp will be released for utility showings soon by Roebling's electrical division. The movie details a series of tests conducted recently at Line Material's new Thomas A. Edison Laboratory.

Photo at left shows the gyrating cables and clamps during one of the tests. Purpose of the tests was to determine what short-circuit forces could be withstood by the Roeclamp, which is made of methyl methacrylate. A 128-ft test span was set up using a $\frac{5}{16}$-in. EHS cop-



GENERATOR STEP-UP TRANSFORMER, rated 60,000 to 250,000 kva at 115 to 161 kv, and 100,000 to 250,000 kva at 230 kv, employing the Preferred Design concept

Large Transformers

OA/FA/FOA, 3) OA and OA/FA.

As announced by J. W. Seaman, general manager of GE's power transformer department, the new design is now applied to three lines of power transformers: 1) Large substation transformers, 12 to 50 MVA, 69 to 161 kv, with or without load-tap changing equipment; 2) Transmission tie autotransformers, 24 to 75 Mva, 115 to 161 kv, with or without load-tap changing equipment; 3) Generator step-up transformers: 60 to 250 Mva; 115 to 161 kv; 100 to 250 Mva, 230 kv.

The expanded program of GE establishes uniform exterior details of transformers such as tank shape, unit height, location of cooling equipment, and bushings. But at the same time, Mr. Seaman points out, it permits "unlimited flexibility" of interior electrical details such as voltage, kva ratings, losses, and impedances. As Mr. Seaman puts it, "The basic principle of Preferred Design is that a transformer is purchased primarily for its function of 'transformation' of electrical energy, rather than as a custom-built assembly of individually-designed mechanical features." The choice of the most desirable mechanical features was resolved by GE by interviewing many utilities and studying recent buying and specification trends.

Besides price reductions, Mr. Seaman cites the following advantages to the new line:

- Accessories and features formerly supplied only at extra cost are now included as basic equipment, such as provision for future addition of cooling equipment, protective relays, lighting arresters, and more CT's.
- Sound level guarantees have been reduced three or four decibels; guaranteed core losses on FOA units are about 15% lower; while, in units with other types of cooling, load losses are reduced about 10%. These are reflected in the total-loss guarantee.
- Self-cooled or fan-cooled units can be upgraded readily because the same basic transformer design is used for both self and forced cooling.
- Greatly improved delivery schedules, faster substation design and construction, and easier installation and maintenance results from uniform mechanical features and accessories.

GE says the cost reductions are possible because the "mechanical uniformity of the transformers has been coupled with an extensive factory renovation," which will eliminate "costly job-shop operation" and replace it with "economical production line techniques."

"An enormously valuable result of this product uniformity, is that a 705 computer can be used in design work to automate much of the routine overhead. Calculations which formerly required hundreds of manhours can now be accomplished in minutes."

Short-Circuit Tests on 5 and 15-Kv Spacer Clamps

perweld messenger supporting the clamps spaced 30 ft apart, except in one test where spacing was reduced to 20 ft.

Power for the tests came from an 800-hp, 2300-v induction motor operating a 60-cycle generator with a 14-ton rotor turning at 3550 rpm. The mechanical energy stored in the whirling rotor is capable of being momentarily converted into over 500,000 kva of electrical energy. The generator will deliver any three-phase voltages from 1500 to 15,000 v. In the tests, a 1,500,000-kva air blast back-up breaker capable of interrupting 80,000 amp opened the test circuit after any pre-set current flow. A synchronous switch made it possible to select the precise time with respect to the wave shape at which the flow of the fault current was initiated. Oscillographs were used to determine the generated voltage, arc voltage and current in the short-circuit arc.

These were the tests conducted on the following combinations of Roeclamps and cables:

- Three tests using 5-kv Roeclamps, #6 AWG soft drawn copper conductor and $\frac{4}{64}$-in. Roeplastic insulation.
- Seven tests using 5-kv Roeclamps, 500 MCM soft drawn copper conductor, and $\frac{6}{64}$-in. Roeplastic insulation.
- Eight tests using 15-kv Roeclamps, 500 MCM soft drawn copper conductor, $\frac{11}{64}$-in. Roecozone. "B", $\frac{6}{64}$-in. Roeprene insulation.

Preliminary conclusions based on the tests are:

- For small conductor sizes, the

(*Continued on page* 58)

Roebling Tests Clamps

(*Continued from page 57*)

short-circuit limitation is based on the thermal capability of the insulation. The Roeclamps were not broken in these tests, but temperatures reached in the #6 copper conductor used were calculated to be 50 to 245C above the 150C limitation recommended by the IPCEA.

• For large conductor sizes, the short-circuit limitation is the strength of the clamp. The four-cycle current required to raise the temperature of a 500-MCM copper conductor to 150C is 100,000 amp. Roeclamps broke at currents far below this.

• Longitudinal spacing of clamps has a great effect upon the short-circuit forces imposed on the clamps. In one test, the spacing between clamps was reduced from 30 to 20 ft. Breakage of the clamps was more severe on this spacing than on previous tests at higher currents.

• Clamps break as a result of the electromagnetic forces and not from the inertial forces caused by the momentum of the moving conductor. In one test, the inertial force was decreased by restricting the movement of the conductor. Despite this, the breakage was more severe than in tests at higher currents and less restriction of movement.

• Short circuits which occur at low ambient temperatures cause greater stresses in the clamps than those at high ambient temperatures.

Tobe Deutschmann Ends Production; New C-D Lab

Tobe Deutschmann ended production of capacitors Sept. 8 at its Norwood, Mass., plant because of operating losses suffered over a period of years. Cornell-Dubilier, 70% common stockholder in the firm, says it has worked out an arrangement to fulfill Tobe Deutschmann's obligations to customers with respect to unfilled orders.

Cornell-Dubilier has also repossessed the plant facilities which it had leased to Deutschmann, and will convert them into a modern 100,000-sq-ft research and development laboratory to concentrate on basic and applied research on capacitors, resistors, and solid state devices.

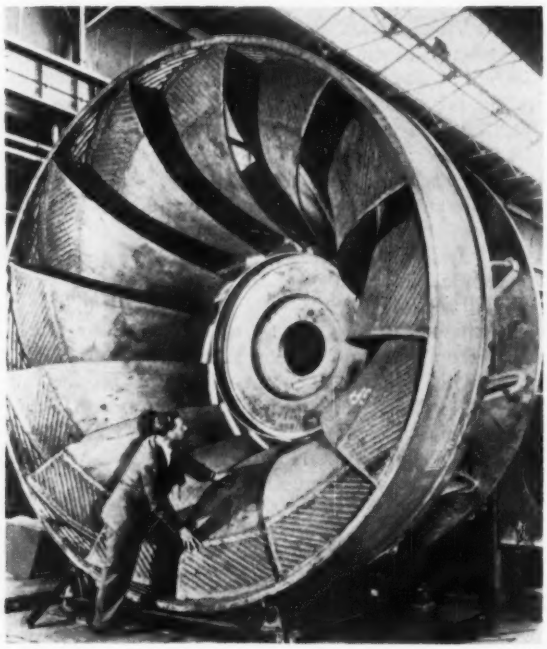


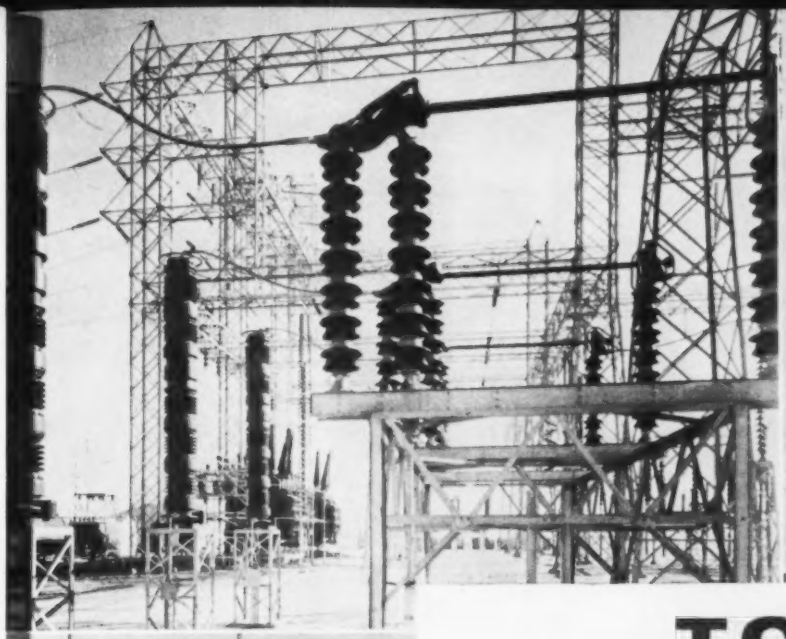
Table Rock Gets Turbines

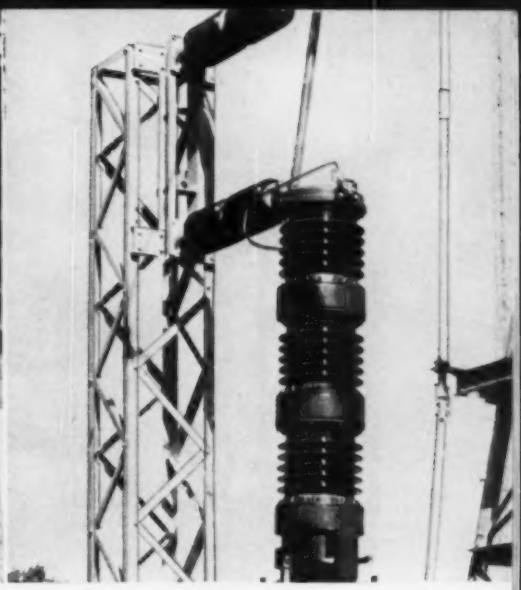
Runner for 68,000-hp hydraulic turbine (above) is almost completed at English Electric's plant, Netherton, England. Application of 15,000-sq-in. of stainless steel stripping has just been made to runner blades.

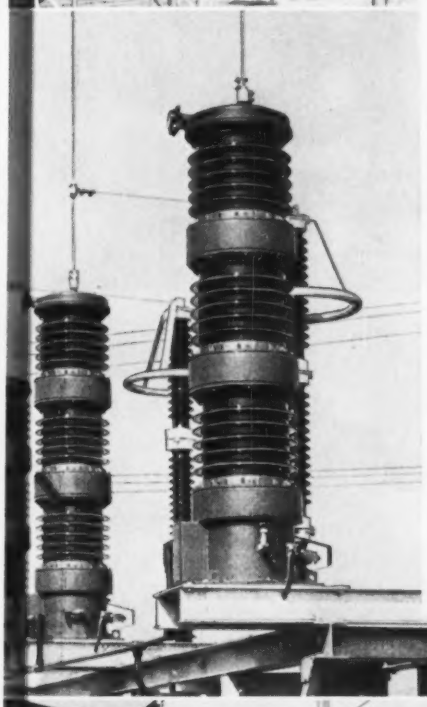
This is the third of four identical turbines EE is making for the U. S. Army Corps of Engineers' Table Rock Dam project on the White River, near Branson, Mo. Two of the turbines and one 121-Mva, three-phase forced air-cooled transformer have already been delivered to Table Rock; a second identical transformer is being completed at the company's Stafford, England, works.

MANUFACTURERS BRIEFS

Baldwin-Lima-Hamilton is awarded $2,246,500 contract for three 48,300-hp hydraulic turbines to be installed at TVA's Wheeler Dam in North Alabama, after underbidding English Electric. The contract for the three generators has not yet been awarded . . . **General Electric** reports the Government has overruled English Electric's contention that the EE bid for four 36,111-kva hydraulic turbine-generators was $68,793 lower than the GE bid. GE was awarded the $5,014,000 contract for the equipment for Barkley Dam on the Cumberland River by the Army Corps of Engineers and now will start working on the units . . . Sale of **Peerless Electric** to **H. K. Porter** is recommended by PE's directors, and stockholders are expected to vote on the plan . . . **Westinghouse** has boosted output and life of mercury vapor lamps. Some lamps are increased from life rating of 7,000 to 10,000 hrs, others from 6,000 to 7,000 hrs, and some color-corrected lamps produce 2,000 additional lumens now . . . **General Electric** will build two 345-kv power circuit breakers for New York State Power Authority's tie line between Robert Moses Power Dam and Niagara Power Project. The 25 million-kva breakers will be located at the Niagara end of the 220-mile transmission line . . . Northern States Power is leasing an extensive radio communications network from **Motorola,** covering its 12 operating divisions in Minnesota and North and South Dakota . . . **General Electric** has developed a new ceramic material, Lucalox, which is made from aluminum oxide powder and is closely related to sapphire and ruby. The material is claimed to have the composition of a ceramic, structure of a metal, and light-transmitting ability approaching that of glass . . . Two packaged power plants have been ordered by the Mexican government from **British Thomson-Houston Export Co,** part of Associated Electrical Industries Group of England. Standard plants with two 6,250-kw turbo-generators originally, and three eventually, will be completed on a single overall-bid basis.







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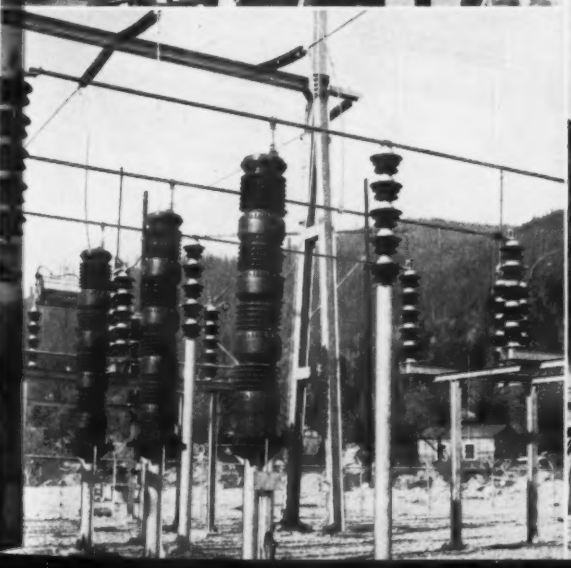
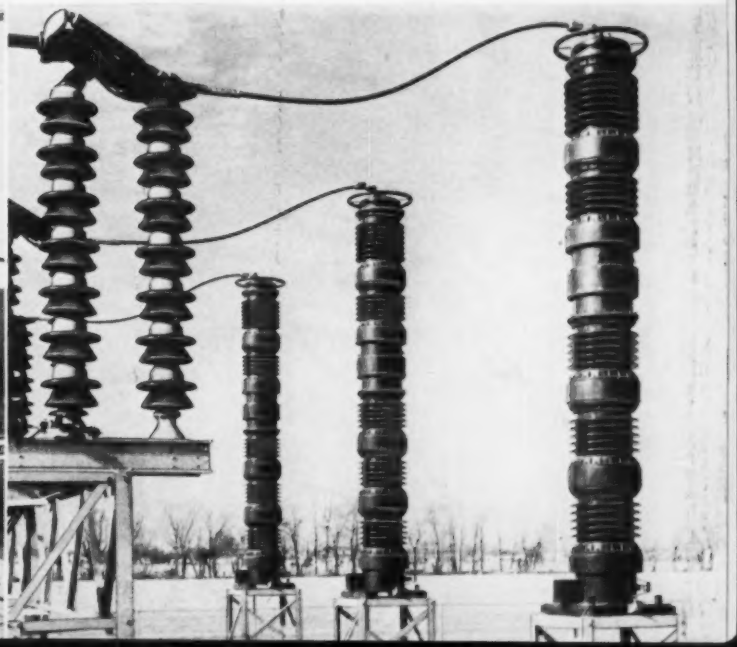
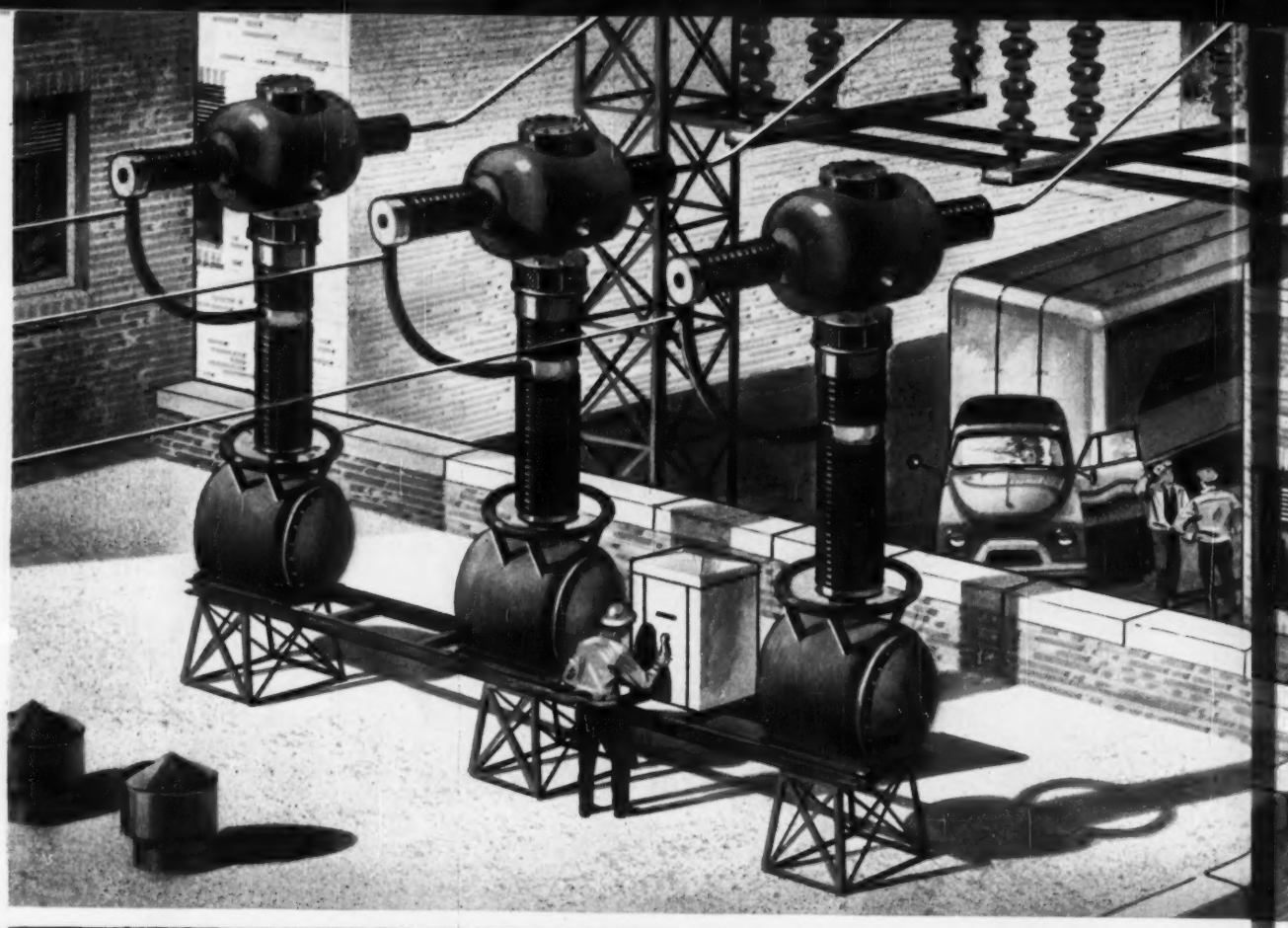
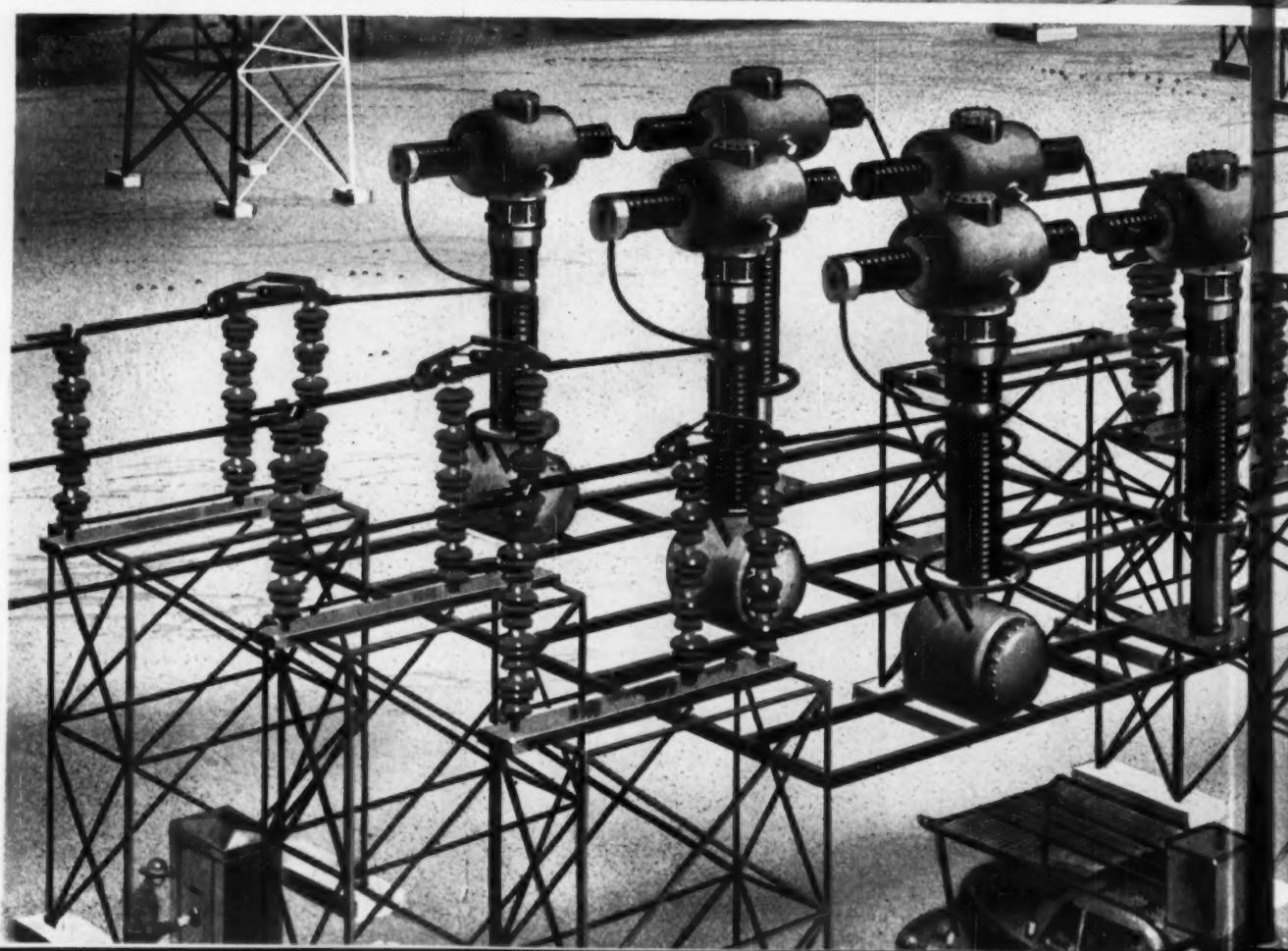
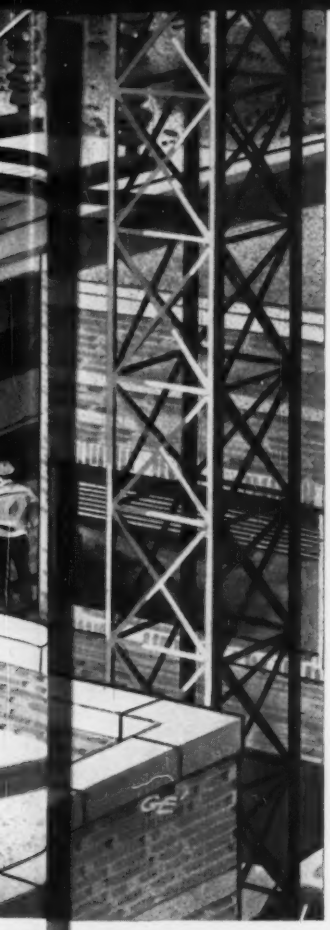
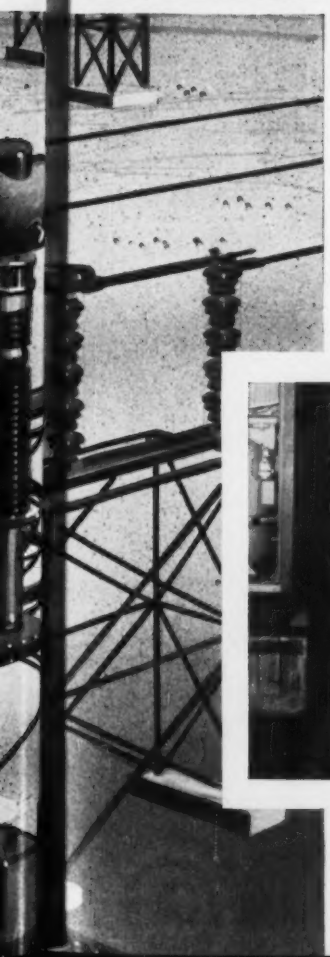












NEW General Electric *AIR BLAST*
Power Circuit Breakers give you . . .

Installation flexibility never before possible

General Electric's new Type ATB Air Blast Circuit Breakers offer you installation flexibility never before possible with oil breakers. You can install Air Blast units on roof tops or on switch structures. Either way, you gain aisle space and save valuable ground area.

General Electric's Air Blast design saves station space in another way, too. The Type ATB is the only Air Blast breaker line available today which offers current transformers as an integral component. Where applied, the gas-insulated CT serves as the base of a column.

Air Blast breakers are 30 to 50% lighter than comparably rated oil units. For this reason, and because no impact forces result from interruption, breakers can be installed on roof tops or in switch structure. When breakers are installed at ground level, concrete required for foundations is drastically reduced. Under average soil conditions, a 230-kv oil breaker requires 31.6 cubic yards of concrete for its foundation. A 230-kv Air Blast unit needs only 7.5 cubic yards.

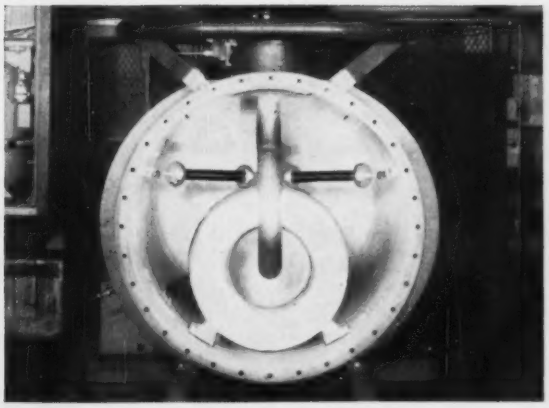
Once foundations are in place, actual installation of the breakers is relatively simple. Current transformer and insulating columns are shipped as a unit and may be handled with a light-duty crane. The interrupter heads are shipped complete, ready to be bolted in place.

The location of the breaker control cabinet is flexible too. It can be mounted upon the breaker structure, or at ground level, whichever you prefer.

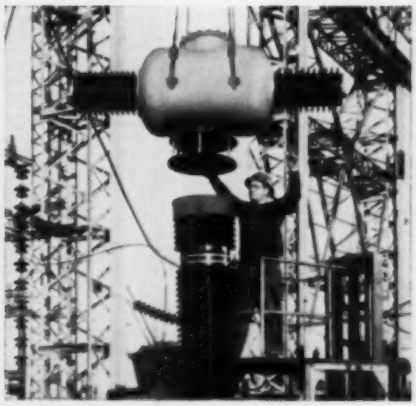
Easier, more flexible, less costly installation is just one of the many major benefits inherent in G-E Air Blast Breakers for transmission voltages. Ask your General Electric Apparatus Sales Engineer to tell you the full story. General Electric Co., Schenectady 5, New York. 491-2

Progress Is Our Most Important Product

GENERAL ELECTRIC



TO SAVE SPACE and reduce components, current transformers are an integral part of the breaker.



ONLY ONE LIGHT-DUTY crane is required for air blast installation. Interrupter heads are shipped complete.

be sure to consider...

TOTAL VALUE

General Electric Master Unit Substations are your best "total value" buy—most advanced transformer, switchgear designs . . . completely integrated for modern, economical power distribution

For a "total value" product appraisal, consider these over-all advantages of factory-built unit substations, then factor in the product superiority of G-E transformer and switchgear components.

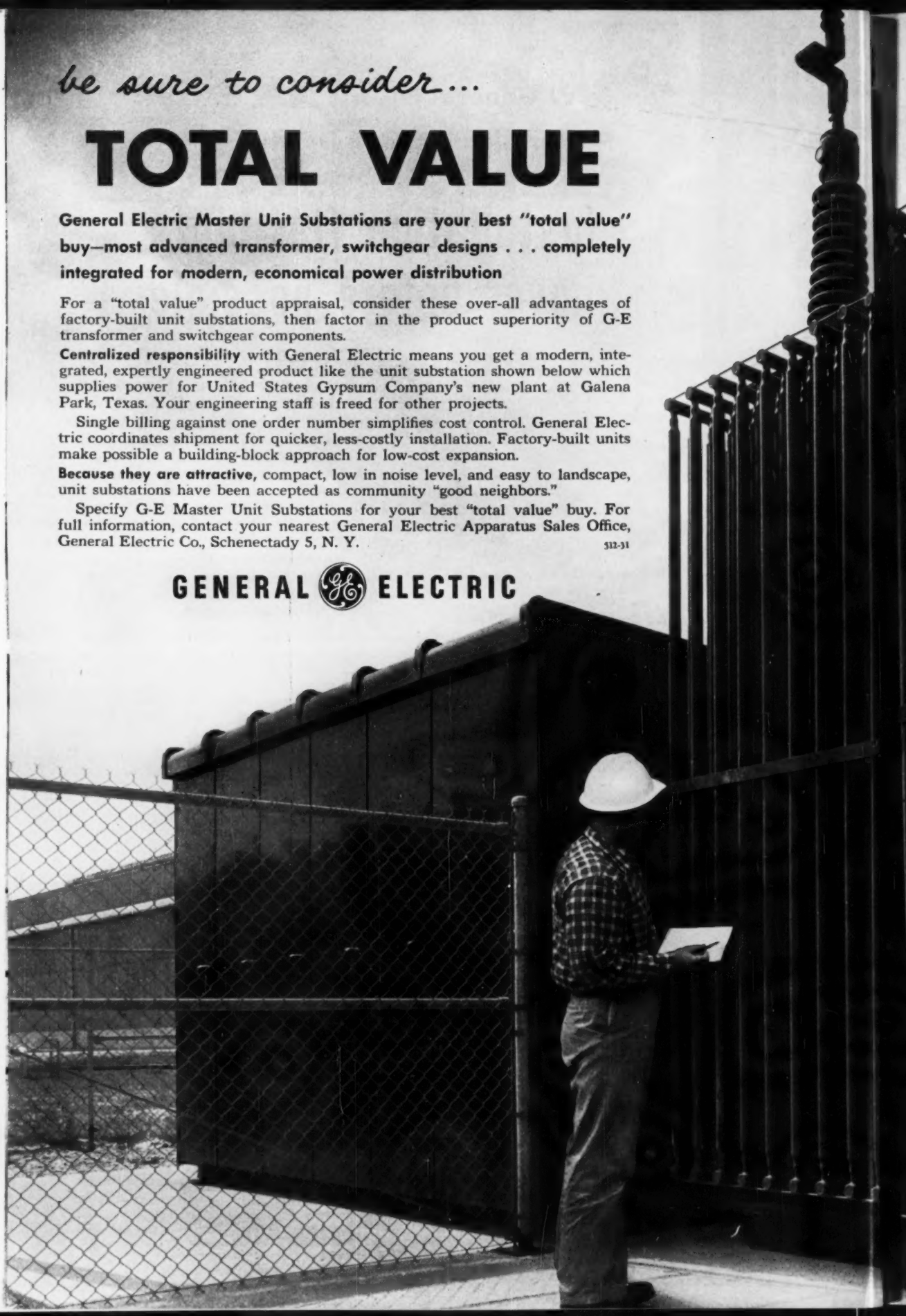
Centralized responsibility with General Electric means you get a modern, integrated, expertly engineered product like the unit substation shown below which supplies power for United States Gypsum Company's new plant at Galena Park, Texas. Your engineering staff is freed for other projects.

Single billing against one order number simplifies cost control. General Electric coordinates shipment for quicker, less-costly installation. Factory-built units make possible a building-block approach for low-cost expansion.

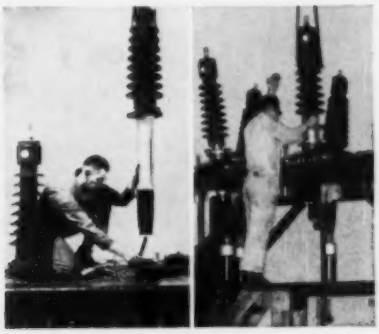
Because they are attractive, compact, low in noise level, and easy to landscape, unit substations have been accepted as community "good neighbors."

Specify G-E Master Unit Substations for your best "total value" buy. For full information, contact your nearest General Electric Apparatus Sales Office, General Electric Co., Schenectady 5, N. Y. 512-31

GENERAL ELECTRIC

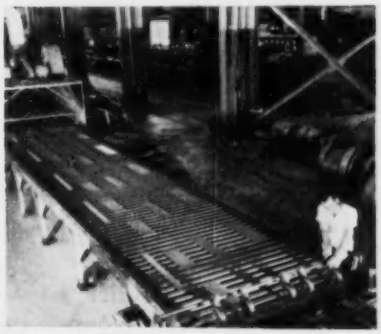


These transformer features are part of G-E Unit Substation value

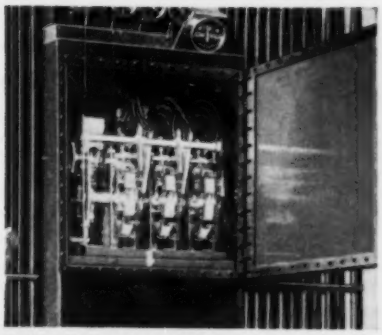


INTERCHANGEABLE BUSHINGS can be converted easily from transformer to breaker application to cut bushing inventory significantly.

PRESSURE-RELIEF DEVICE gives tank protection from excessive internal pressures. Direct-acting mechanical device is rugged, self-resealing.



TEN PERCENT LOWER CORE LOSSES, sound levels 2 to 3 db below industry standards result from new core steel annealing process.



NEW LOAD TAP CHANGER cuts routine maintenance 50% by doubling contact-tip life. Peak operating noise is reduced 20 db.

Procurement & Products

OIL ▶ **Residual oil prices could go up** when and if Taft-Hartley is invoked in the steel dispute, oil industry observers say. Settlement of the strike would be even more likely to strengthen residual price, which has firmed in spite of declining demand from steel and other affected industries. But, they add, chances of a winter shortage of heavy fuel oil are slim, as the President could quickly adjust import quotas to head off a threat.

STEEL ▶ **Here is steel inventory picture** at major electrical manufacturing plants as strike enters its twelfth week: Daily supply problems are already arising at Allis-Chalmers, but these have been solved. Sometime in October, Allis will begin cutting into its normal inventory and this could seriously affect production at some plants. Westinghouse has sufficient inventory to run through November in apparatus products—enough to run through October in appliances. General Electric has sufficient steel stocks to carry its turbine operations through the end of the year, but is already cutting back on at least one line of appliances.

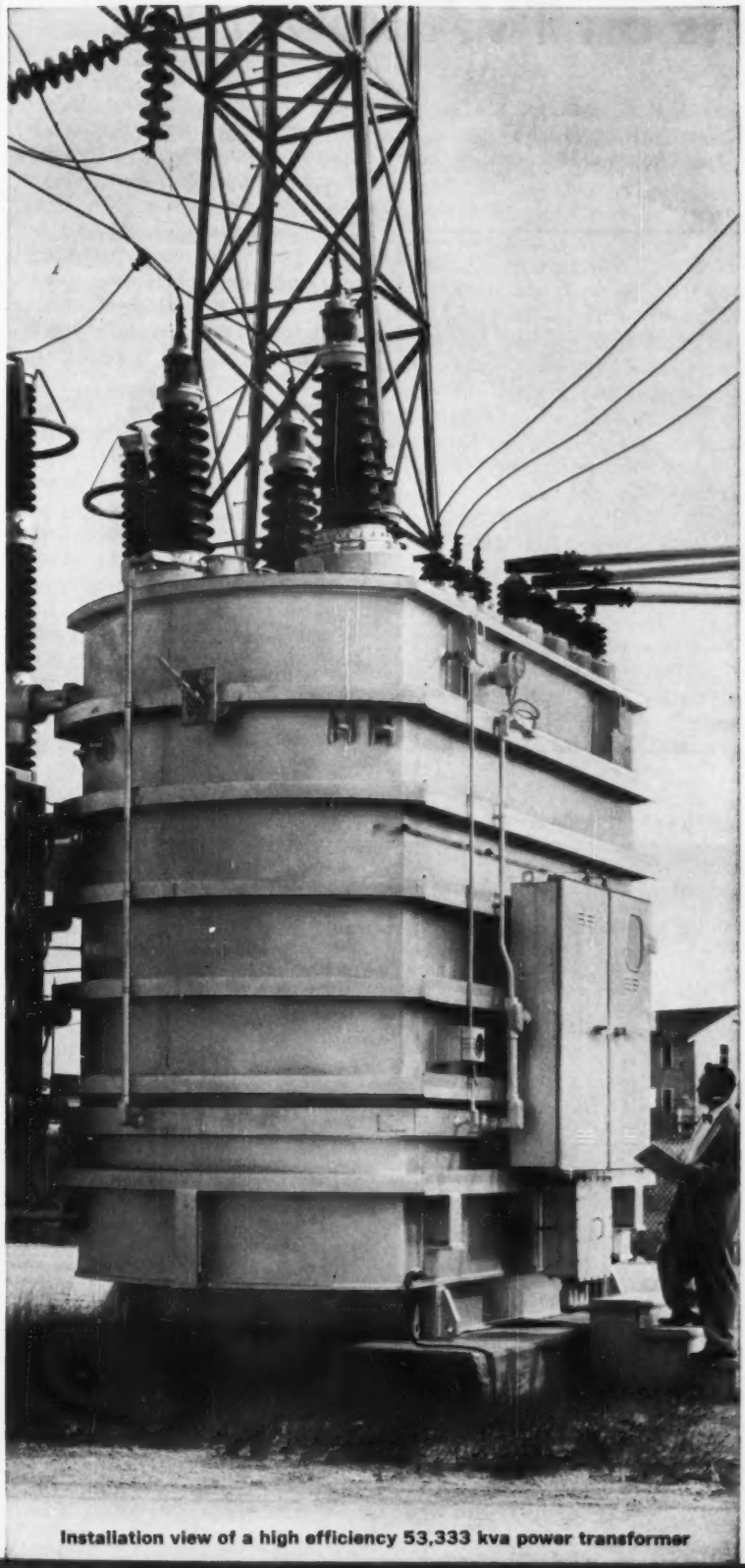
ALUMINUM ▶ **Aluminum market is tapering back** as one result of the steel strike reports American Metal Markets. The third quarter aluminum business is now expected to drop below second-quarter levels because of the effects of the steel strike, says the metals magazine.

RESEARCH ▶ **Electrical machinery manufacturers spend 4.1¢ out of every sales dollar for research and development**—an increase of nearly 24% over last year. Electrical machinery ranks fifth among all industries in the proportion of its revenue devoted to R&D according to the results of a survey recently released by the American Management Association. Engine and Turbine manufacturers spend 2% of their sales dollar for R&D according to the survey.

TARIFF ▶ **Tariff bill has been introduced in the Senate** which would establish the precedent of setting duties so as to equalize foreign and U. S. wages, thus offsetting the low-wage advantage enjoyed by foreign manufacturers. Main purpose in introducing the bill is to stimulate constructive discussion and research during the Congressional recess.

SUPPLIER ▶ **Tobe Deutschmann ends production of capacitors** at its Norwood, Mass., plant because of operating losses suffered over a period of years. (Full story on p 58.)

News of Manufacturers ..... page 56
New Equipment ..... page 75
Readers Service ..... page 140



Installation view of a high efficiency 53,333 kva power transformer

UNIVOLT® 35 TRANSFORMER OIL

High Oxidation Stability... Low Power Factor

Univolt 35 is an outstanding transformer oil because of its excellent oxidation stability, low power factor and lasting insulation action. This dependable, proved-in-use product is refined from a high quality, specially selected straight mineral oil. Its highly desirable characteristics include low viscosity, freedom from acid, alkali and corrosive sulfur, and compatibility with the varnish finishes of coils.

Univolt 35 offers outstanding performance under the conditions of extreme heat produced by peak summer loads serving commercial and home air conditioning. The utmost care is taken in transporting Univolt 35: it is shipped in specially prepared and inspected tank cars which are loaded indoors.

Univolt N36 is another high quality transformer oil. Perfected by Esso Research, it possesses all the characteristics of Univolt 35 plus an effective oxidation inhibitor. For complete information, contact your nearest Esso Office or write: Esso Standard Oil Company, 15 West 51st Street, New York 19, New York.

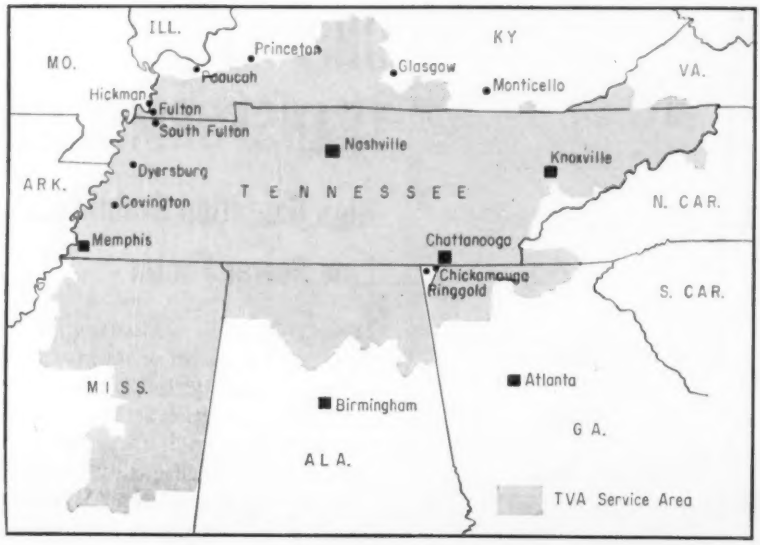
Esso

In Industry after Industry..."ESSO RESEARCH works wonders with oil"

Battle Sharpens on TVA Power Bid

It's not the table stakes that have power companies in the TVA region aroused. Instead, it's the likelihood that a growing number of kibitzers will try for the kitty.

This poker-game parallel best seems to fit the situation in the Tennessee Valley area where nearly a dozen communities are bidding for access to TVA power. Under an amendment to the TVA bond bill these communities (shown by black dots in the map at left) and the agency may enter into power supply contracts with each other. Except for these towns and a 5-mile periphery zone, TVA is held to its July 1957 territory.



Ringgold, Ga., one of the towns excepted in the bill, has become a focal point in the companies' battle to hold onto their service areas. Georgia Power Co officials are dead set against a sale of its system there at any price, and Ringgold Mayor Marvin Partin is just as determined to get public power.

Some months ago Mayor Partin offered $200 per meter for the 600-meter system. Georgia Power has valued its property there at $400 per meter. In a recent Atlanta

HOW RELIABILITY IS BUILT INTO THE MAGNE-VALVE ARRESTER

by R.W. FRAHM—Manager of Lightning Arrester and Cutout Marketing

Every General Electric Magne-valve arrester is subjected to exacting factory tests to assure high mechanical and electrical strength.

Each Thyrite* valve element disk receives multiple impulse discharges to stabilize and measure its discharge voltage characteristics. Each assembled unit receives a production line 60-cycle sparkover test and a test to assure freedom from radio noise. A vacuum test ascertains the arrester housing's ability to seal out atmospheric moisture. Thus, each functional element of the arrester is separately checked. Units which fail to measure up in any area are immediately rejected.

Field experience has proven that these tests provide you with the best distribution arrester available. Since 1953, when General Electric introduced the first magnetic gap controlled distribution arrester, 1,300,000 arrester years of near-faultless service have been compiled—substantial evidence that quality and reliability are built-in features of every G-E Magne-valve arrester.

We'd like to tell you more about our complete line of distribution arresters. Contact your General Electric representative or write Section 435-21, General Electric Co., Schenectady, N. Y.

*Registered trademark of General Electric Co.

GENERAL ELECTRIC

Exacting factory tests assure t

meeting GPC Executive Vice President John Lastinger told Partin the company will hold onto its Ringgold facilities.

Early in the year, Partin asked TVA's power manager, G. O. Wessenauer to approve a TVA power supply for the town if and when it gets its own distribution facilities. To date, Wessenauer has not given Partin a definite answer.

Partin, however, told Electrical World last fortnight that "TVA has promised power to us—unofficially."

If Georgia Power will not sell the local system, Ringgold or the North Georgia Electric Cooperative will build duplicating lines, Partin says.

"I'm looking for word from TVA in a few days," he adds. "I think they'll agree, officially, to furnish us with public power. Within 30 days after we get official word from TVA, we'll begin building our own facilities."

Spokesmen for the company say: "We've made our stand and we aren't backing down . . . We aren't selling."

Substation Changes Reduce Costs

(*Continued from page* 51)

age records. The records show that an average transformer has a failure rate of 1 per 50 years of service, and the average 34.5-kv circuit an extended outage, 3 mins or longer, about once per year.

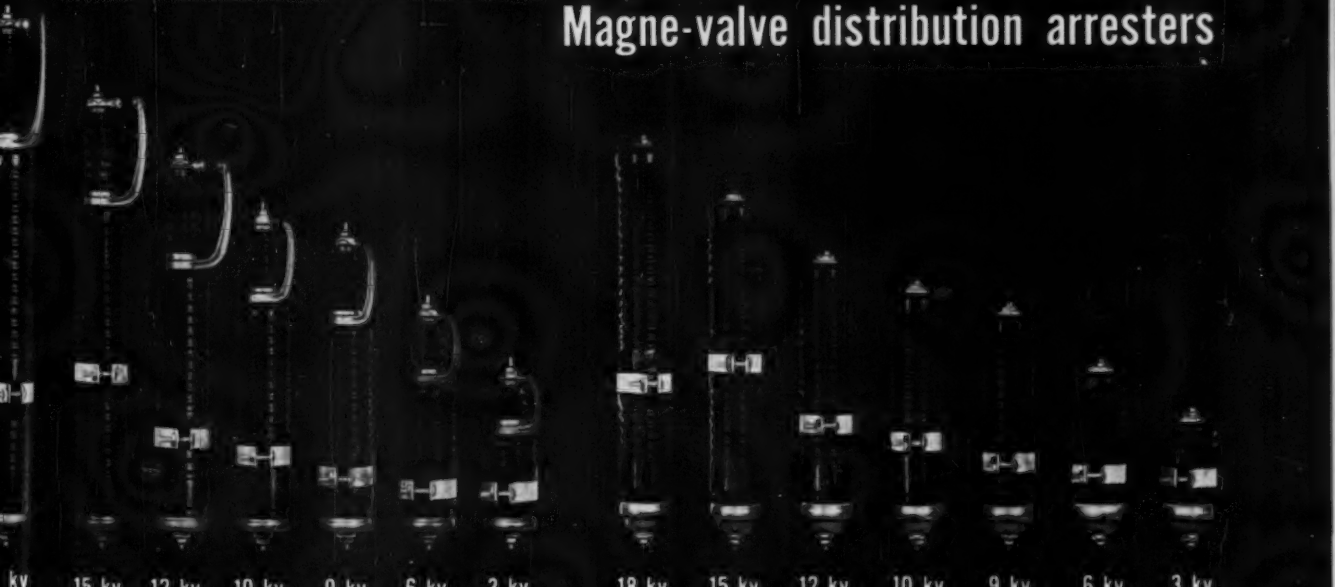
With a three-transformer substation, the accepted rating for three 10/12.5-Mva OA/FA units is about 35 Mva with the high-voltage selective scheme; this is the same as that of the low-voltage selective scheme. Again, this rating could be increased several Mva with adequate feeder ties. When a transformer fails, the two remaining transformers can pick up about 27 Mva on a continuous basis, a mobile substation another 5 Mva, and adjacent substations about 3 Mva.

Operating under emergency loading conditions is not expected for periods longer than one peak-loading cycle. Emergency loading conditions can normally be relieved in 10 to 12 hrs, the time it ordinarily takes to install a mobile substation. The high-voltage selective switching scheme reduces dollar investment per accepted substation Mva of rating.

High-voltage selective scheme costs per accepted kva of rating are approximately 3½% less with the high-voltage selective scheme for a one-unit installation, due primarily to the difference in cost between a breaker and disconnect switch in the transformer low side. With two units installed, cost per kva is considerably less, due to less equipment and the higher accepted ratings.

Maintenance cost of the high-voltage selective scheme is lower. For a two-unit substation there are three less breakers to maintain. The estimated annual maintenance charges per breaker are $90, so that an annual savings of $270 should be realized.

ure the reliability of General Electric
Magne-valve distribution arresters



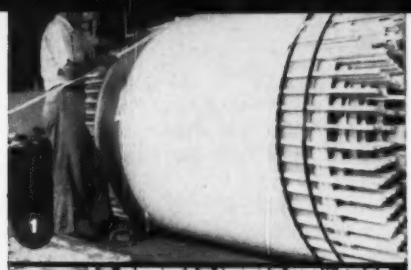
GENERAL ELECTRIC

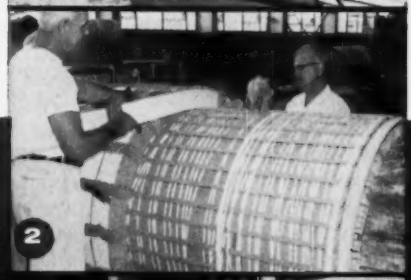
STEP
BY
STEP
TO A

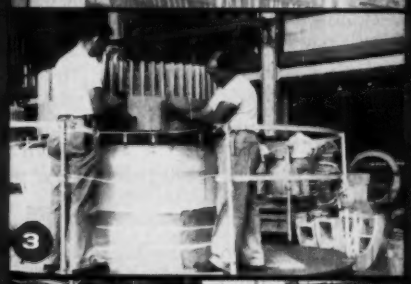
217,000 KVA, 230 KV TRANSFORMER

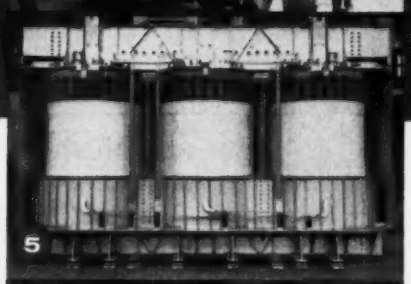
for POTOMAC ELECTRIC POWER COMPANY'S DICKERSON GENERATING PLANT

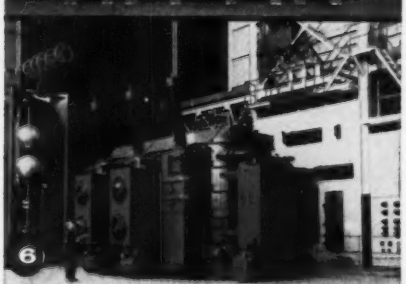
1. Winding High Voltage Coil
2. Winding Low Voltage Coil
3. Flanging High Voltage Coil
4. Raising Stacked Core
5. Low Voltage Side of Core-and-Coil Assembly
6. Testing Completed Transformer
7. Shipping Transformer

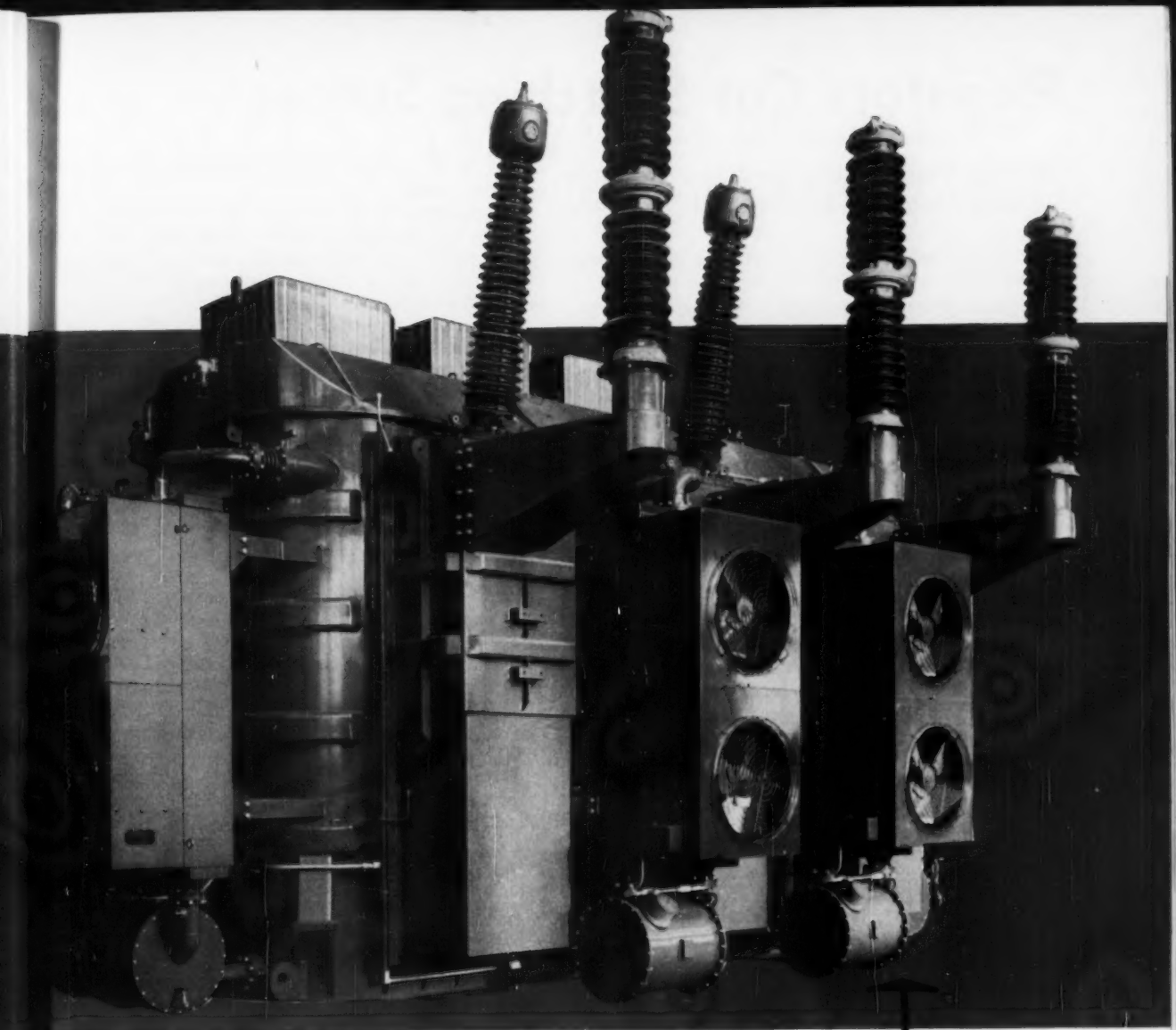












This power transformer is now installed at Potomac Electric Power Company's new 55 million dollar Dickerson Generating Station, located on the Potomac River in Upper Montgomery County, Maryland. The unit is a 217,000 KVA, three phase, type FOA, transformer having a high voltage rating of 234,000 Grd. Y/135,000 volts, with 2-2½% no-load taps above and below normal and a low voltage rating of 13,500 volts delta.

The transformer is connected through isolated phase bus duct to Unit #1, a 175,000 KW generator, which is the largest generating unit on the PEPCO system. The generated voltage of 13,500 volts will be stepped-up to 230 KV for transmisson. This transformer is an important link in the PEPCO system, and it exemplifies Moloney's ability to build large power transformers of any type or rating to customer's exact specifications.

For additional information on the engineering ability and facilities which make Moloney particularly well-qualified to build large power transformers, contact your Moloney representative. Specify Moloney Transformers . . . All Along The Line.

MEEO-8

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TORONTO, ONT., CAN.

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MOLONEY ELECTRIC COMPANY

Transformers For Utilities, Industry, and Electronic Applications

Resistors Cut Switching Surges

Carbon blocks contained in porcelain weather housing eliminate flashovers

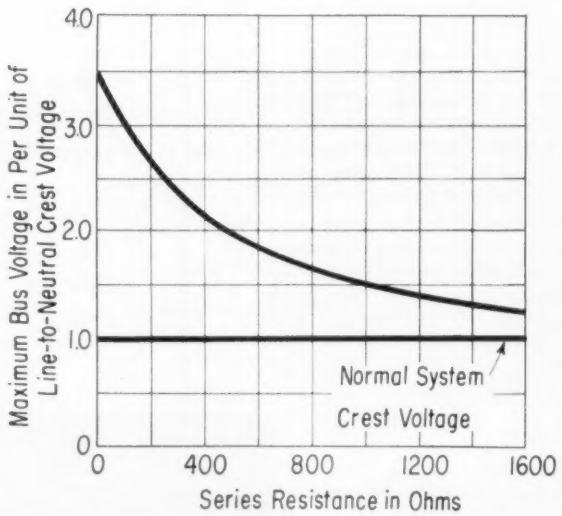
J. W. SKOOGLUND, Electric Utility Engineering Dept, Westinghouse Electric Corp, East Pittsburgh, Pa.

A voltage-suppressing resistor can help eliminate severe overvoltages caused by restriking in air-break disconnect switches while interrupting capacitive circuits. Field tests indicate that a 1,500-ohm resistor is ample to prevent the overvoltages which might occur on a 345-kv air-break switch.

The resistor is composed of three 500-ohm units making a total series resistance of 1,500 ohms. The resistors are carbon blocks contained in a porcelain weather housing. The assembly is mounted on an insulator stack adjacent to the stationary jaw end of the disconnect switch. Grading rings on the resistor fittings serve the dual purpose of arcing contacts and radio interference suppressors.

When the switch blade is closed, the resistor is bypassed to power current flow but is energized at line potential. As the blade is opened, arcing first occurs between moving blade and switch stationary contact. As it is opened farther, the arc transfers to various arcing contacts on the resistor, progressing upward until arc contact is established between the blade end and the top resistor contact. At this position arc extinction occurs with 1,500 ohms in series with the circuit.

The resistor is dimensioned to maintain a short arcing space until the 1,500 ohms have been inserted in series. If a larger arc distance were permitted with a smaller resistance, full overvoltage damping would not be obtained. A resistance of 1,500 ohms is required at all voltages and is independent of system operating voltage.



SERIES RESISTANCE effect on maximum transient voltage on bus being de-energized shows 1,500 ohms is sufficient

Development of the resistor scheme followed from a study that included extensive field tests. Fast-response cathode-ray oscillographic equipment was developed and used to obtain continuous 35-mm records of system voltage at various station locations.

The tests showed that voltages up to 700 kv crest exist at the open end of the bus being de-energized. Operation counters on the lightning arrester on this bus indicate an average of eight discharges on the three poles of the arrester during a switch operation.

Overvoltages are not limited to 345 kv alone but are also present on low voltage station-service and control circuitry. Voltages as high as 673 v were recorded on a 250-v dc breaker control circuit. A 495-v surge was recorded on the 115-v station service supply, but considerably higher voltages were experienced during one test, when an internal flashover occurred in the power supply of an oscillograph.

Examination of the equipment and the internal clearances involved indicates that at least 1 to 2 kv is necessary to cause flashover. Overvoltages on lower voltage circuits are potentially as severe as those on the 345-kv circuit because of the possibility of causing weakened insulation or undetected grounds which may lead to control circuit failure during breaker operation.

A detailed study was based on the field test data. Many schemes of analysis were attempted, starting with lumped circuit R-L-C constants, with only the long lines connected to the station bus represented as a surge impedance. However, study revealed that practically the entire circuit must be represented as distributed constants because of the high-frequency wave forms involved. A method was developed using superposition and the lattice diagram to obtain the transient voltage for any location in the station. Although these overvoltages are classed as switching surges, they are very fast compared to those produced by other switching operations—reaching crest in less than 10 microsec.

The disconnect switch while opening produces about 2 restrikes per cycle for 3 to 4 sec. After each restrike, the current extinguishes, leaving a voltage trapped on the bus. Approximately ½ cycle later, when system voltage has assumed the opposite polarity, the voltage across the switch becomes sufficient to flash over the air gap, causing another restrike. This continues until sufficient dielectric strength is built up across the open switch to prevent further restriking.

Voltages produced at this location are very near the arrester sparkover. They do not often exceed it, however, as an average of only eight operations was recorded on the three poles of the lightning arrester. These operations probably occur near the end of the switch-opening cycle, when large voltages exist across the switch just before a restrike.

The resistors illustrated are on a high-voltage test line and interrupt about 1.5 amp of line charging current at 345 kv. The resistor has thermal capacity to sustain a much greater current, but additional tests are necessary to determine the arc-transfer between contacts under various wind conditions.

A NEW ERA IN RELAY LIFE AND RELIABILITY!

A-B QUALITY

THEY MAY LOOK ALIKE, BUT

these new relays completely outmode the usual concepts of relay life and reliability.

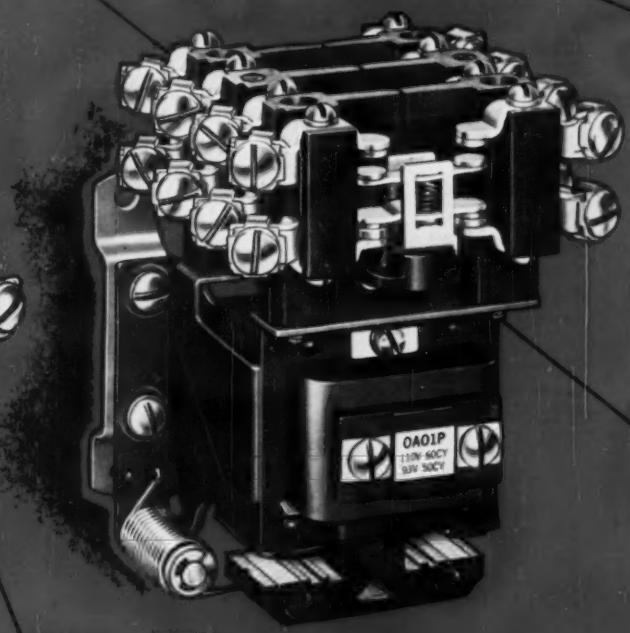
For years the Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and their consistent, trouble free operation. In having produced millions of these relays, we learned how to improve them. Thus, the new line of Type B and Type BX relays was designed to set a new level of performance standards.

Turn the page and see the outstanding features of these new Bulletin 700 Type B and Type BX relays. For the same price, they offer you even greater value, greater reliability.

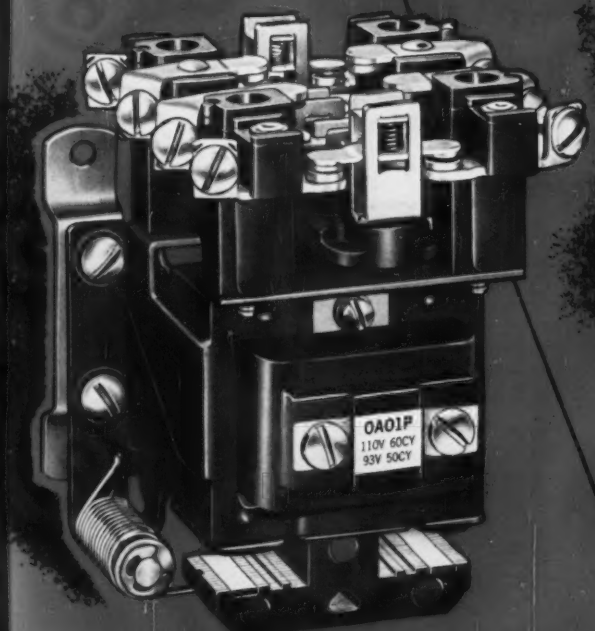
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

old Bulletin 700
Type BX-440 Relay

old Bulletin 700
Type B-400 Relay
with 4 N.O. contacts



new Bulletin 700, Type BX-440A
AC Control Relay can be wired for normally open or normally closed contacts



new Bulletin 700, Type B-220A
AC Control Relay with 2 N.O. and 2 N.C. contacts

ALLEN-BRADLEY
Member of NEMA
QUALITY MOTOR CONTROL

7-59-MR

NEW BULLETIN 700 RELAYS

TYPE B AND TYPE BX

provide these improved features

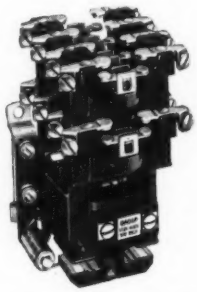
1. New mechanical design gives *at least* 5 times greater operating life.
2. New contact motion provides 10 times greater electrical reliability.
3. Compact construction—new relays are structurally improved with no change in size.
4. Complete interchangeability. Mounting dimensions of new relays have not been changed.
5. Rugged, high efficiency cast plastic coil. New, improved coil fits *all* Bulletin 700 relays.
6. New, stronger, movable contact crossbar—fits Bulletin 700 relays now in service.
7. Improved stationary contact blocks. These new blocks can also be used on present models of the Bulletin 700 relay.
8. Increased life and reliability—*no increase in cost.* These new, improved relays are priced the same as previous Allen-Bradley models.
9. The letter A is added to the Bulletin 700 relay type number merely to distinguish the new line.
10. These new relays are Allen-Bradley's "thank you" to our many customers who have bought millions of Bulletin 700 relays over the years.

A-B QUALITY

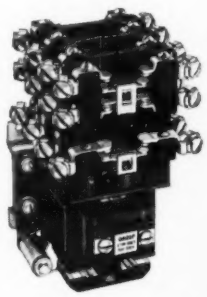
The old Bulletin 700 relay was first placed on the market some 25 years ago. Today, millions of these relays are in daily service—all over the world.

None of the old relay "values" have been lost in the new designs. Instead, these "values" have been greatly improved. The new relays feature a simplified, longer life, solenoid construction. The double break, silver alloy contacts are the same—always in perfect operating condition—without cleaning or filing. The operating coil has been greatly improved—it cannot be damaged by atmospheric conditions, no matter how severe.

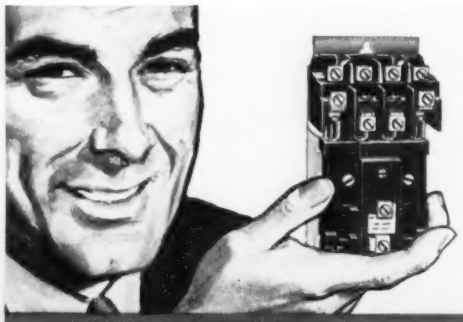
No one can deny the popularity of the older Bulletin 700 relays. The new relays—with their superior features—will be an even better answer for any and all relay applications.



TYPE B, GENERAL PURPOSE
Bulletin 700, 8-pole relay. Made with 8 N. O. and no N. C., or up to 4 N. O. and 4 N. C. contacts.



TYPE BX, UNIVERSAL
Bulletin 700, 8-pole relay with both N. O. and N. C. contacts. Changeover is made by reconnecting incoming lines.



HERE IS ANOTHER REMARKABLE ADDITION TO THE ALLEN-BRADLEY RELAY LINE

It's new . . . and it's different. This unusual Bulletin 700 convertible contact relay has contacts that can be changed from normally open to normally closed operation (or vice versa)—in just moments. A screwdriver is all it takes to do the job—no additional parts are needed. Like all A-B relays, it's good for millions of trouble free operations. Watch for announcement and full details of this new convertible relay soon!

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

7-59-MI

QUALITY MOTOR CONTROL

ectrical World Special Report

SEPTEMBER 1959

ELECTRIC utility methods

CONSTRUCTION • OPERATION • MAINTENANCE

Bent Tube Extensions Stop Boiler Drum Cracking
Stirling boilers will be fitted with extensions to prevent cracking at blowdown valve openings in the lower drums — p 104

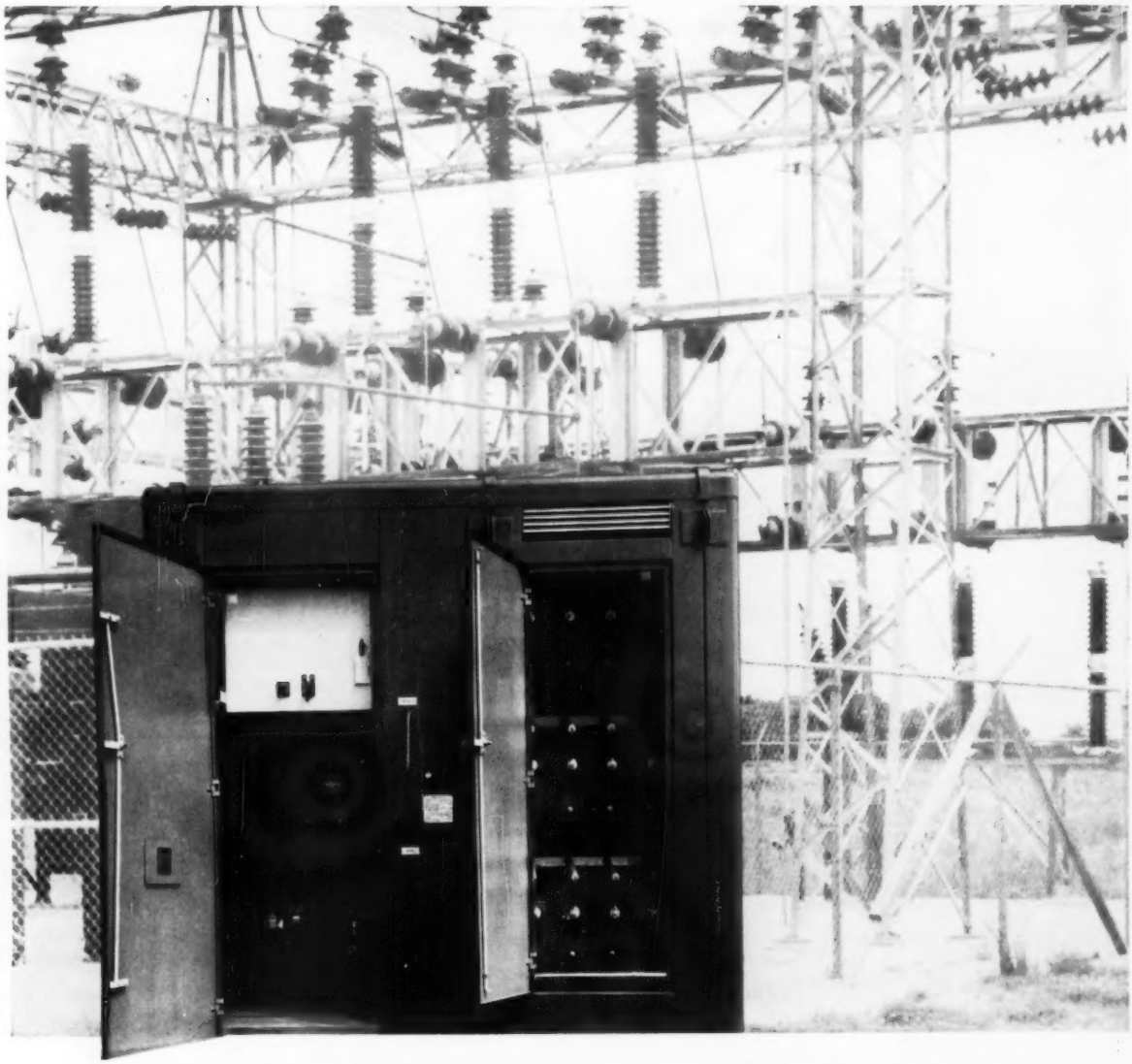
Production Line Aids Meter Testing
Centralized testing of 17,000 meters annually will save costs and reduce meters in stock to 2% — p 99

Skin Divers Check Submarine Cable
Armed with still and movie cameras, two divers patrol up to two miles of cable per day in depths down to 40 ft — p 102

Regular Features

Construction — p 108
Operation & Testing — p 118
Maintenance & Repair — p 124

New Equipment — p 75
Safety — p 132
Stores & Shops — p 136
Manufacturers Literature — p 130



NEW FROM WESTINGHOUSE . . . **MOD-UL-VAR-50**

Prewired, Enclosed Capacitor Banks Cut Costs From Purchase Through Installation

The new Westinghouse Mod-ul-var-50 enclosed capacitor banks are shipped to you in one complete assembly with 50-kvar capacitors installed and wired. All that is necessary at the installation site is setting the equipment in place and connecting it to the line.

In Mod-ul-var-50 equipments, 50-kvar capacitor units are factory installed into 1200-kvar modules. The power entrance or switch compartment and the required number of modules for up to 6000-kvar total capacity are bolted together, wired and shipped to you in one complete assembly, or in sections, depending on your requirements at the installation site. The use of 50-kvar units and the method of manufacture save you manhours in installation time and up to 16% in purchase price over conventional equipment using 25-kvar units.

Future expansion for additional capacity is as easy as removing the end compartment, adding factory-assembled modules, and replacing the end compartment.

Let us show you how Mod-ul-var-50 enclosed capacitor equipments can save you dollars in *lower initial cost, reduced installation time* and *ease of future expansion.* Call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60984

YOU CAN BE **SURE**...IF IT'S

Westinghouse

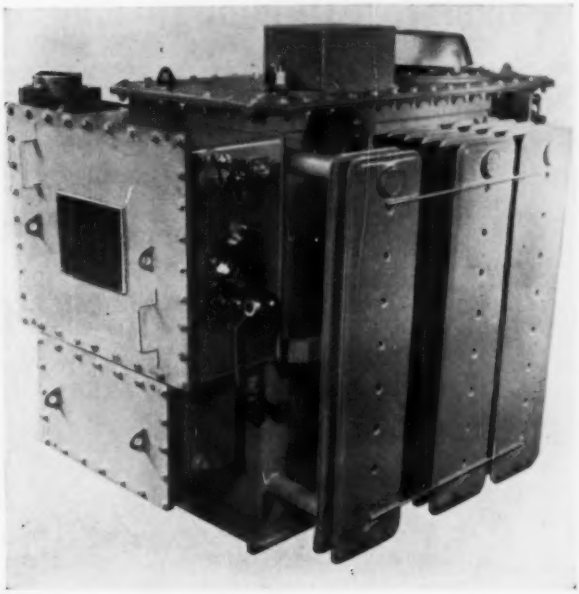
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

NEW EQUIPMENT

To obtain more information on these items, use code numbers indicated for each item when filling in Reader Service Card

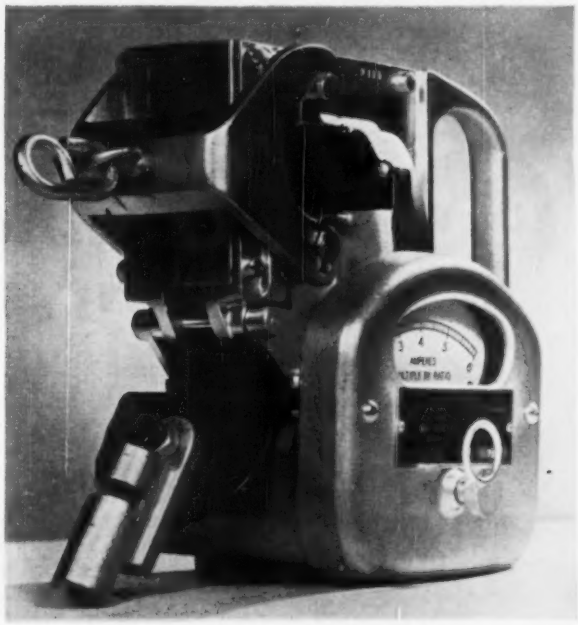
Network Transformer . . .

. . . offers a mechanical relief device with self-lapping seating surfaces and a drum-type, double-ring tap changer with spiral spring snatching unit. Transformers are rated from 225 to 3,000 kva, 2.4 to 34.5 kv. They have 3-position high-side interrupting/grounding switch, key interlock to tap-changer cover, and stamped panelbox radiators in vault or submersible types with bolted or welded covers. **Queensboro Transformer & Machinery Corp, 115-25 15th Ave, College Point, N. Y. (1)**



Lightweight Folding Crane . . .

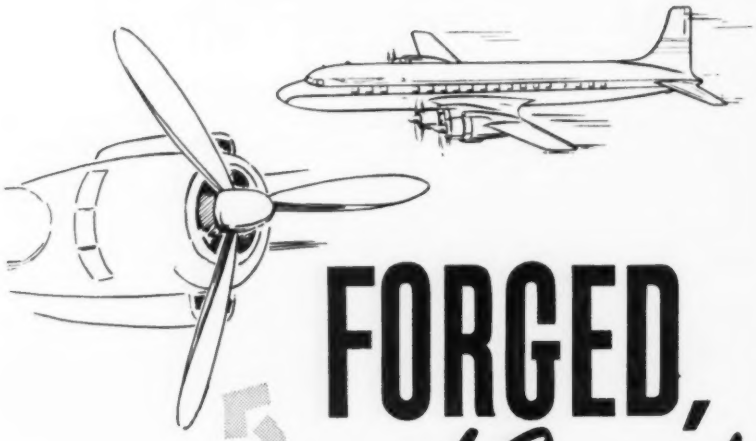
. . . mounts in 13-in. space between cab and truck bed. Patented slewing gear provides for precise positioning of load. Hydraulic controls govern all movement. Model F-4400X FOCO-CRANE lifts 2.2 tons to 21 ft; boom extends to 15 ft, 3 in. **FOCOWIL Corp, 79 W. Monroe St, Chicago, Ill. (2)**



Hot-Line Adapter Kit . . .

. . . converts standard Max-I-Meters to dual-use instruments for reading current of primary or secondary voltages. Main attachments are a pole hook for opening or closing the instrument clamp, a bayonet holder and plate for lifting instrument to primary circuits, and an eye-ring attachment to the reset knob. Conversions of standard instruments may be made in the field. **HD Electric Co, 760 Osterman, Deerfield, Ill. (3)**

(More New Equipment on page 76)



FORGED, *of Course!*

LIGHTER

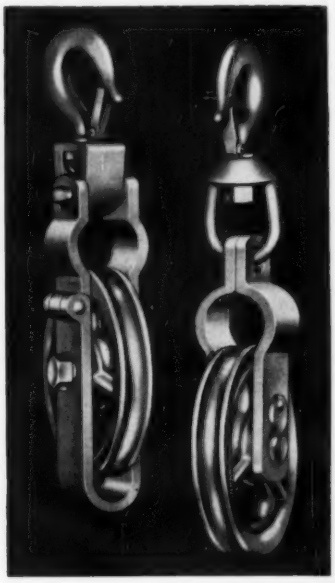
STRONGER TOUGHER

Drop Forged Aluminum

BTC Suspension Clamps

Wide range of sizes
Superior resistance to shock and fatigue
Positive holding power
Specify the best — BTC Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION
HI-LINE HARDWARE DIVISION • CORTLAND, N.Y.



Stringing Block . . .

. . . for static wire has sheave of drop forged steel with completely machined rope groove. It is available in two types—No. 9311 has full strap with safety locking head pin; No. 9611 has modified strap construction with sheave pin cam lock. Both types incorporate articulated swivel safety hook and widened throat for passage of pulling connections and sleeve splices. Blocks are offered in various sizes for all types of static wire through 5/8 in. diameter.

Sherman & Reilly, Inc, First and Broad Sts, Chattanooga 2, Tenn. (4)

Thimble Clevis . . .

. . . provides quick, efficient method of making corner or dead-end conductor attachments. The conductor is looped around the wire groove of the Hubbard

(*Continued on page* 78)

DIRECT BURIAL OF TRIANGLE TRIOPRENE RR CABLE gives low-cost trouble-free systems

It wouldn't be a good practice to bury any RR cable directly in the earth where mechanical damage might cause an outage. BUT, in practically all other situations involving voltages up to 5000 volts, contractors and engineers are finding this versatile power and lighting cable pays off in installation savings and trouble-free service.

Protected by a Trioprene sheath, Triangle's special neoprene compound, RR Cable is flexible, lightweight and tough. It has good aging and heat resisting properties, and is designed to give long-time trouble-free service. It's easier to handle, splice and terminate than metallic sheathed cable. Its first cost is less, and it requires neither conduit nor ductwork under most conditions. In addition to direct burial, RR is also suitable for aerial and duct installations.

Find out more about this versatile power cable.
Write for a copy of the Triangle RR Cable folder.

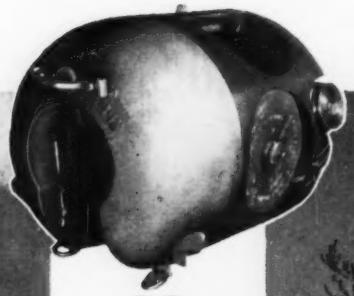
Buy right—buy from your distributor

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

"It MUST Be Right!"

CIRCLE 77 ON READER SERVICE CARD 77



Neale Model "K"

END
TREE-TRIMMING
PROBLEMS

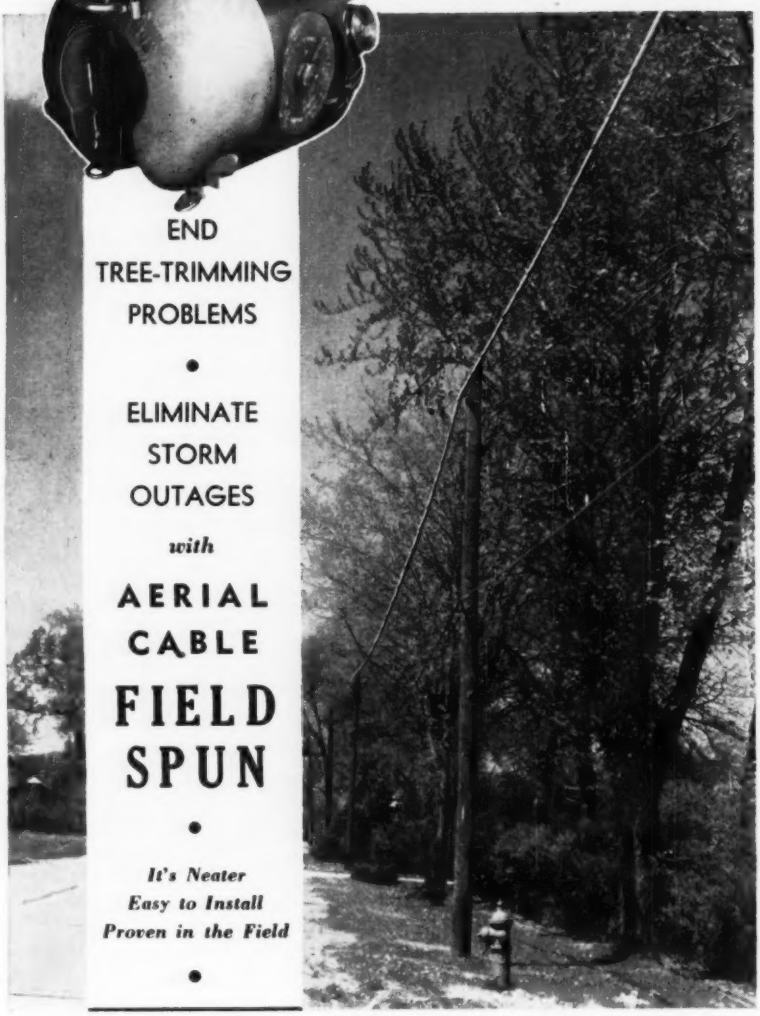
•

ELIMINATE
STORM
OUTAGES
with
AERIAL
CABLE
**FIELD
SPUN**

•

It's Neater
Easy to Install
Proven in the Field

•



The new Model K pull-type Spinner was designed especially for power cables, with a background of many years' experience in telephone cables. It has been adopted as standard by many electric utilities.

- Lashes three cables as large as 2" O.D. at one time.
- Lashes single cable as large as 3½" O.D.
- Lashes with one or two lashing wires.
- Lashes with wire of any type or size.
- Works on any size strand.
- Weighs only 36 pounds (less wire).

For descriptive information and application data please drop us a note.

CABLE SPINNING EQUIPMENT CO.

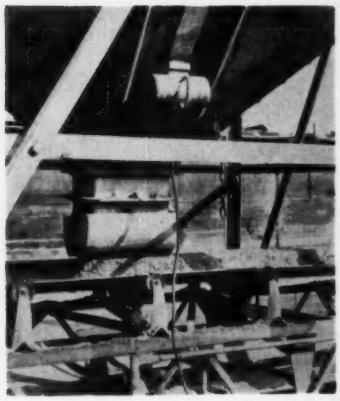
3100 Topeka Ave. Topeka, Kans.

Phone CE 2-7234

Thimble Clevis . . .

(*Continued from page* 76)

No. 674 open-side thimble clevis instead of threading through the clevis. The thimble is 2¼ in. in diameter and will accommodate strand or wire ¾ in. or under.
Hubbard and Co, 200 S Michigan Ave, Chicago 4, Ill. (5)



Vibrators . . .

. . . remove materials from outdoor bins regardless of weather. The Model RC units are water and dust-tight to preclude failure due to exposure. They employ the rotating eccentric shaft principle but are self-contained. The line is available in 3-phase ac at all common voltages. Working frequency is 3,600 impulses per min.
Cleveland Vibrator Co, Clevelend 13, Ohio. (6)

Crossarm Pin . . .

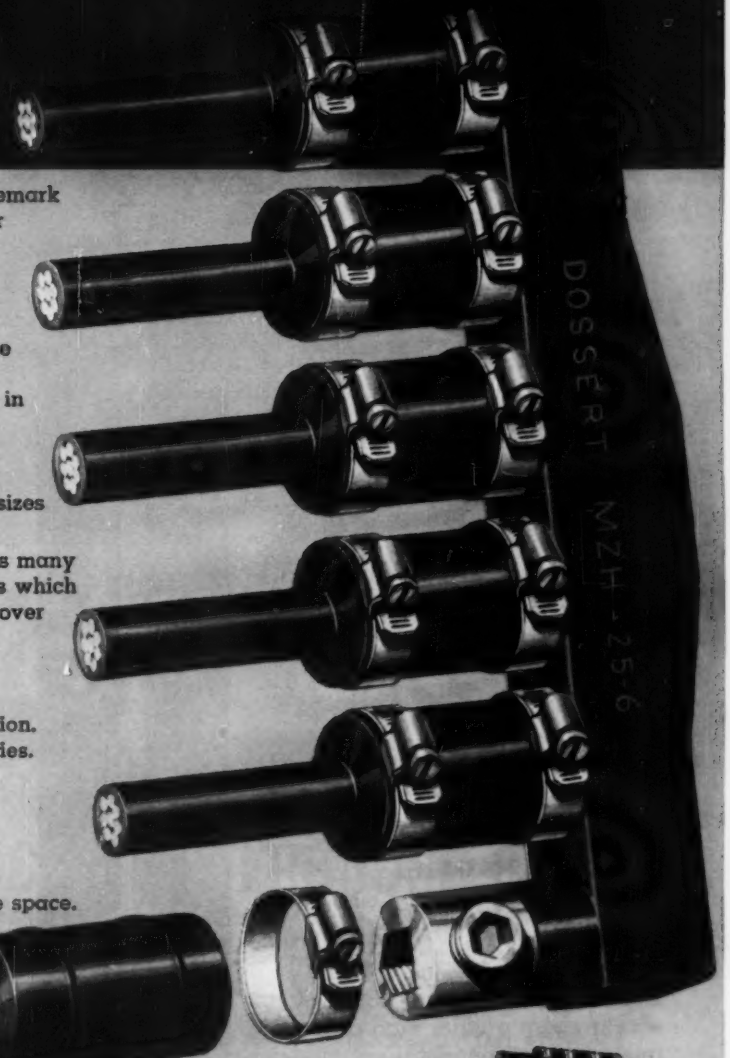
. . . with integral 15-deg angle provides a strong, one-piece installation of a high-voltage pin-type insulator. The forged steel angle crossarm pin will hold an

(*Continued on page* 80)

DOSSERT MICON*

(Tapeless Underground Connector)

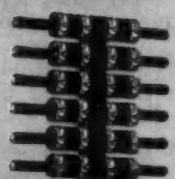
More COMPACT
More RELIABLE
LOWER in COST



MICON is a Dossert Mfg. Corp. trademark for a tapeless underground connector especially designed for residential and industrial underground distribution systems. This brand of connector is fully insulated for joining up to 8 electrical cables where watertightness must be insured. MICON tapeless connector is simple in concept and well proven principles have been used in its design. No extra components are needed to accommodate a wide range of cable sizes in any outlet position.

MICON brand tapeless connector has many outstanding features and advantages which constitute a substantial improvement over older style and competitive fittings. The most important ones are:

- Lower cost of complete fitting.
- Less field time required for installation.
- Wide cable range without accessories.
- No plastic parts to crack or chip.
- No extra bushings required to fit different insulations.
- All parts are designed for easy accessibility and easy installation.
- Compact design conserves manhole space.



Dossert MICON brand tapeless Crab-type Connector is especially designed for joining up to 12 electrical cables. This connector is an original Dossert design and adheres to the same principle as the tapeless type. Write for special catalog.

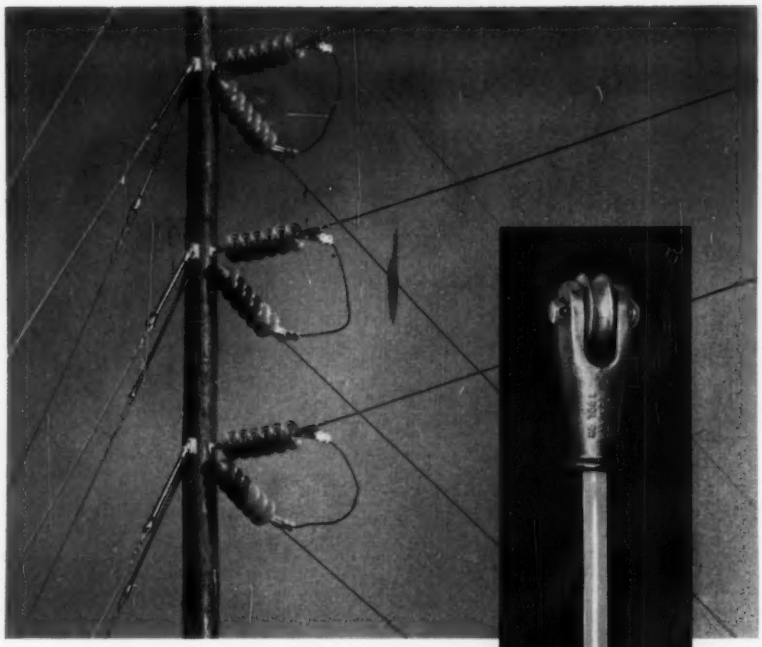
Request also complete UNDERGROUND CATALOG UG 53-1

*Pat. Pend. Reg. Trade Mark applied for

50

DOSSERT MFG. CORP.

249 Huron Street, Brooklyn, New York



Proven in Service

EMPIRE FIBER GLASS GUY STRAIN INSULATORS

Featuring:

STRENGTH • INSULATION • PERMANENCE • APPEARANCE • ECONOMY

GLASS-STRAINS introduced by Empire Metal Products Company to the utility market years ago.

Fiber glass rod produced by Empire Metal Products Company with strength greater than any guy wire requirement.

Carefully designed end fittings to provide the ultimate in strength and holding power are attached to rod by exclusive patented process.

CATALOG AVAILABLE

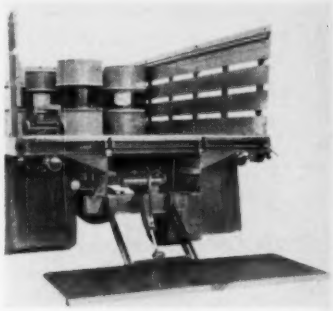
EMPIRE METAL PRODUCTS CO.
5443 West Roosevelt Road
Chicago 50, Illinois

Crossarm Pin . . .

(*Continued from page* 78)

insulator in a vertical position on "wish bone" construction, reducing insulator stress and minimizing breakage. It can also be used as a corner pin.

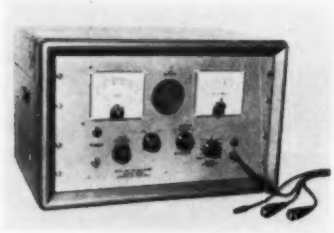
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis. (7)



Tailgate Loader . . .

. . . of 1,500-lb capacity is suitable for stake body, flat bed and van body trucks from ¾ ton through 2½ tons. Known as the Venco EB-1500, it has a vertical travel of 48 in. and net weight of 500 lb. Three standard platform sizes, as well as special sizes to order, are available. The loader is made by Santa Anita Mfg Corp, Temple City, Cal.

Collins Associates, Inc, Box 38, Cincinnati 11, Ohio. (8)



Insulation Tester . . .

. . . checks both ac and dc test characteristics. Ac tests provide data on total leakage, resistive leakage, ac resistance, power fac-

(*Continued on page* 82)

150-TON AMERICAN POWERHOUSE CRANE GIVES BIG LIFT ON BIG BEND PROJECT

Designing custom-built lifting equipment for specific jobs is earning the skilled engineers at American Hoist Pacific Co. an enviable reputation. On this installation for the California Oregon Power Company, for example, Pioneer Service and Engineering Co., Chicago, consulting engineers on the project, specified and purchased a 150-ton capacity American Powerhouse Gantry Crane.

Some of the many outstanding features of this heavy-duty machine include:

1. A three-reduction load brake gear reducer, providing more precise load lowering control.
2. Rugged load trolley construction has an all-welded fabricated frame, welded steel drum, oil tight gear case and anti-friction bearings throughout.

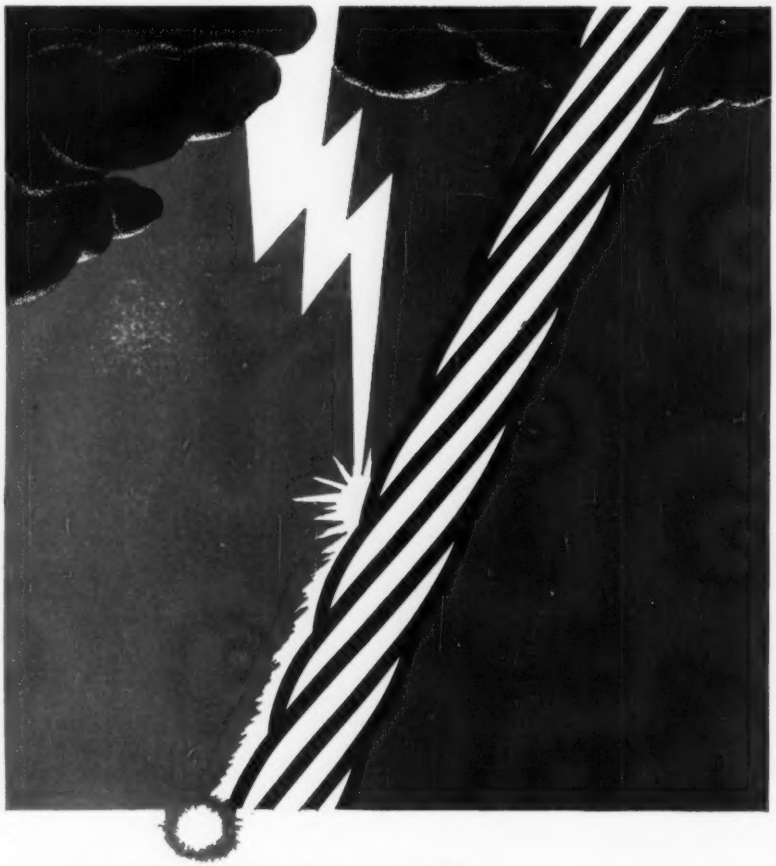
On this job . . . on any job . . . expert consultants from American Hoist Pacific Company provide full-time assistance from drawing board through job completion. Recognized engineers with years of experience, they will show you how specially designed American Cranes will give you better service. Solving unique materials handling problems is their specialty.

AMERICAN HOIST Pacific Co.

4975 Third Avenue South **Seattle 4, Washington**

Wholly Owned Subsidiary of American Hoist & Derrick Company

CIRCLE 81 ON READER SERVICE CARD



Safely grounded...with

CF&I Galvanized Steel Strand

The CF&I Image—a giant steelman—stands for the dependability that's built into all CF&I steel products. One of them—Galvanized Steel Strand—is a safe, sure way to ground electrical installations and equipment.

Available in seven- or three-wire constructions, CF&I Galvanized Steel Strand for ground wire is made in accordance with ASTM Specification A-363. In addition, it can be produced to *your particular specifications.*

CF&I Galvanized Steel Strand, (made to ASTM Specification A-122), is also recommended for guy and messenger wire, and is available for quick delivery either from a nearby CF&I warehouse or from your local electrical distributor.

6931-A

GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise Butte • Denver • El Paso • Farmington (N. M.) • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City Phoenix • Portland • Pueblo • Salt Lake City • San Francisco San Leandro • Seattle • Spokane • Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION**—Atlanta • Boston Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

CF&I OFFICE IN CANADA: Montreal

CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg

Insulation Tester . . .

(*Continued from page* 80)

tor, inherent capacity and breakdown strength. When used for dc testing, insulation resistance in megohms may be checked at any test voltage within the range of the instrument. It is designated the Model 103/105.
Slaughter Co, Piqua, Ohio. (9)

Bucket Loaders . . .

. . . have extra-long lift arms to provide greater clearance for dumping into high-sided trucks, railroad cars and tall hoppers. The arms, 2 ft longer than standard, are available as optional equipment on W-9 and W-10 Terraload'rs. They give both loaders a clear dump height of 11 ft 6 in. with bucket retracted and 10 ft 2 in. with bucket fully dumped.
J. I. Case Co, Industrial Div, Racine, Wis. (10)

Neoprene Coating . . .

. . . provides excellent chemical, abrasion and weathering resistance for the protection of metal, wood, concrete, cloth and some plastics. Designated as "CORO-GARD 1706" Brand protective coating, it has high adhesion to unprimed steel, aluminum, copper, galvanized steel, concrete, wood and glass fiber reinforced polyester plastics. The coating will air-cure to a tough rubbery protective film that has good re-

(*Continued on page* 84)

when weather's rough and time short . . .

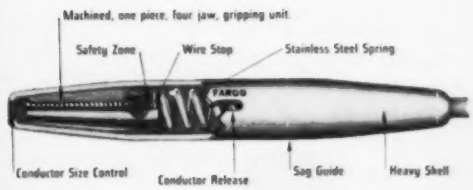
USE FARGO'S

AUTOMATIC SPLICE

FIT RIGHT! WORK RIGHT! EVERY TIME!

When the weather is against your linemen . . . when customers need service fast . . . use FARGO AUTOMATIC SPLICES. Under any conditions, the "*automatic*" works right and you can always depend on it. Even sagging is easier . . . each splice is marked with a sag guide.

Get set right now for that hectic weather ahead. Permanent automatic splices are installed without tools . . . and they are reusable.



details make the difference!

piece jaw design assures perfect alignment of the jaw segments for a better conductor grip. Fargo "automatics" are available for copper, aluminum, aluminum alloy, and high strength messenger in a

LINE MATERIAL INDUSTRIES
McGraw-Edison Company
Milwaukee, Wisconsin

FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

FARGO

"HE'S BEEN UP THERE FOR 15 YEARS

. . . TO GET A BETTER SLANT ON THINGS"

The person who designs a streetlight control without ever having climbed a pole is like a boat builder who has always lived in Iowa — he just can't appreciate the user's point of view. And to a lineman installing a photoelectric control, the right "point of view" is a matter of his safety, how long he has to spend up there and how easily he can get the control in service.

In the design and construction of the 6600A Series controls, we've tried to make the lineman's job just as safe and easy as possible. The 6600A is small and light enough to be carried in one hand, and the case indentations give a gloved hand a better grip. We could have painted it sky-blue pink, but plain gray attracts fewer rocks and BB guns. The whole "package" is rugged (even though you ought not to expect it to work if it's bounced on the pavement from 30 feet up); the bracket can be used in a pinch as a foothold, yet it doesn't clutter up the pole.

Color-coded lead wires from the adapter socket have good strain relief — and connection instructions are on the nameplate. If you want to use your own wiring, the twistlock socket comes with terminal screws that will take stranded wire up to #10.

Since a 6600A should be oriented to face between NW and NE, the design allows full 360° rotation. This directional characteristic and a half-second time delay also simplifies testing — with his gloves *on*, the lineman can check out the installation in nothing flat.

Certainly each of these items is a small thing in itself. But taken together, they add up to a practical control that minimizes risk and problems for the lineman. They are not the result of genius on our part, but simply 15 years of observation and experience. The Fisher-Pierce Co., 82 Pearl St., So. Braintree 85, Mass.

FP

FISHER PIERCE

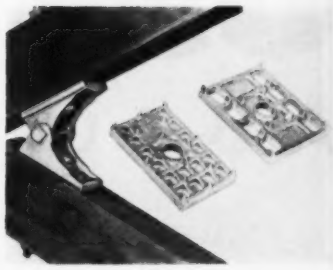
PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

Neoprene Coating . . .

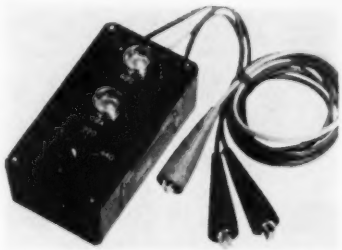
(*Continued from page* 82)

sistance to corrosive action of chemicals and fluids. Costs are cut by elimination of primer.
Adhesives and Coatings Div, Minnesota Mining & Mfg Co, 900 Bush Ave, St. Paul 6, Minn. (11)



Connector . . .

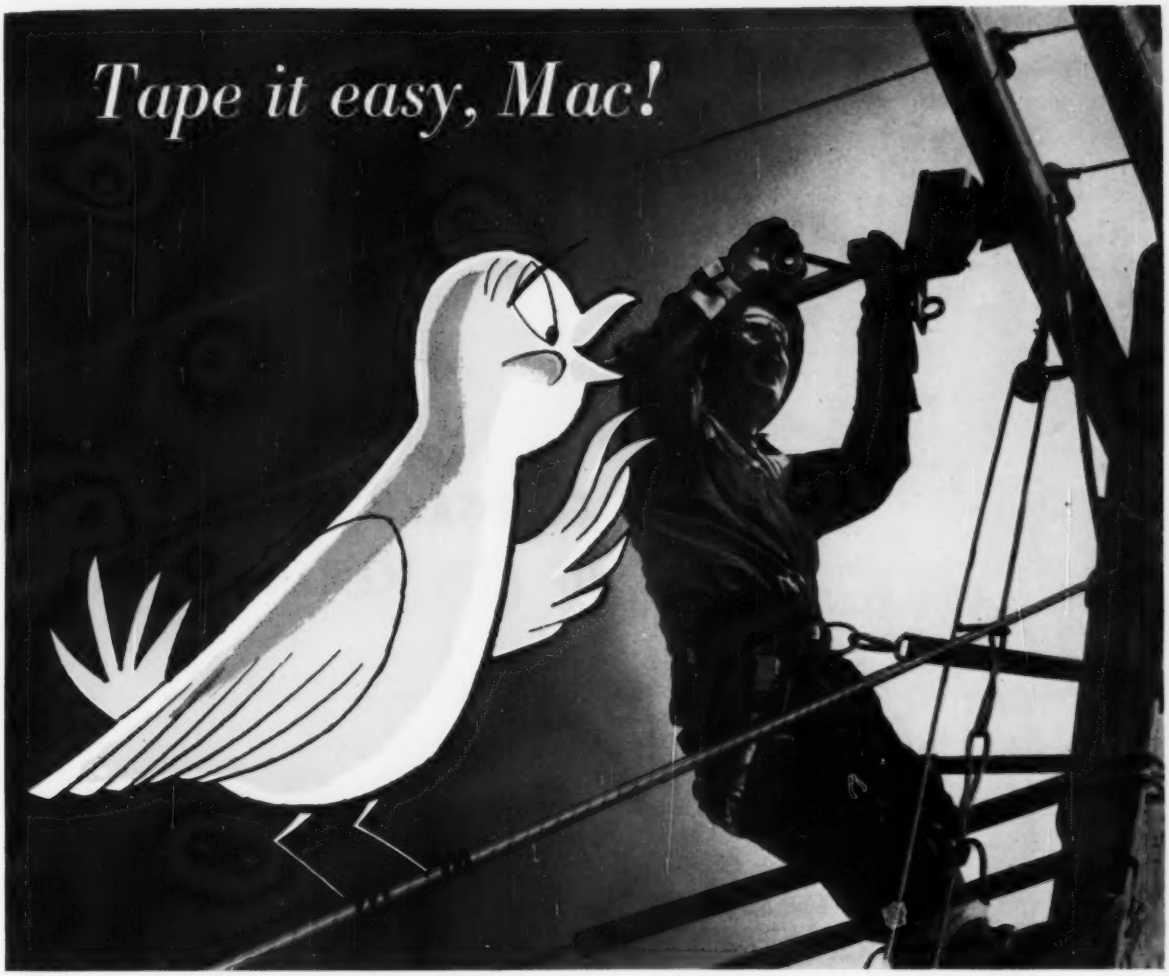
. . . for butt connections in dimension timber is easy to install. The Flat Universal Angle Connector requires only a single bolt attachment for each member. The flat Grid Gain contacting surface provides maximum stability and facilitates framing.
Malleable Iron Fittings Co, Branford, Conn. (12)



Sequence Indicator . . .

. . . reads 120, 240 and 480-v systems. The convenient pocket-size instrument, measuring 3x5x 2-in., is known as the Model 40. It has no moving parts or batteries and is used on 60-cycle systems.
Associated Research, Inc, 3777 W Belmont Ave, Chicago 18, Ill. (13)

(More New Equipment on page 88)



Gold Seal Tape splices neatly, fast

It has high dielectric strength without bulk — a big advantage in many splicing jobs. It's elastic . . . easy to mold into a neat, thin wrapping. Just what the doc ordered for cramped areas, but we birds see more Gold Seal used for insulating cable splices than any other tape. High service line or terminal box, quality and convenience *talk* — and that's Gold Seal Plastic Tape, in the handy 20 ft. roll. Try it! Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

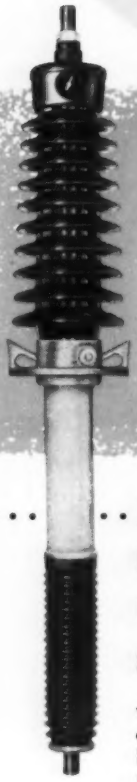
Ten 20 ft. rolls in the Handy Pack can
Single 60 ft. rolls in individual metal cans

Gold Seal Tape

IN HANDY 20 FOOT ROLLS

Gold Seal FRICTION — RUBBER — **PLASTIC** Tapes . . . Commercial and Specification Grades

CIRCLE 85 ON READER SERVICE CARD 85



IMPORTANT NEWS ABOUT COST-SAVING IN INVENTORIES OF REPLACEMENT BUSHINGS

. . . . . **ONE**

BUSHING . . . .

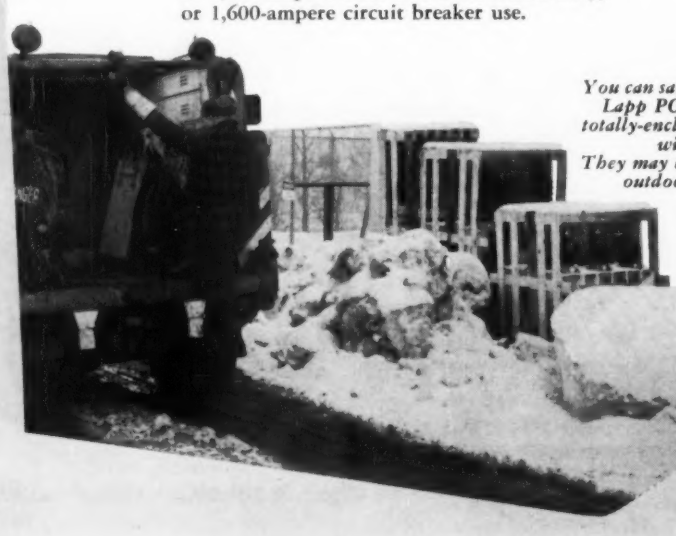
PLUS ONE

SPARE TERMINAL . . . .

will provide complete interchangeability . . . a 400-ampere draw-lead transformer bushing . . . a fixed-conductor 1,200-ampere bushing for circuit breaker or transformer use . . . for each operating voltage 69 kv and below.

At 92 to 161 kv, one POC-A unit (with extra terminal and circuit breaker ring) provides for 800-ampere draw-lead service, 1,200 or 1,600-ampere fixed-stud transformer installation or 1,600-ampere circuit breaker use.

At 180 and 196 kv, with only one spare terminal, the POC-A bushing adapts for 800-ampere draw-lead service, 1,200 or 1,600-ampere fixed-stud transformer duty, or 1,600-ampere circuit breaker use.



You can save on storage space, too. Lapp POC-A bushings are totally-enclosed, moisture-proof, with porcelain insulation. They may be stored indoors or outdoors indefinitely with complete safety.

at every voltage rating, 15 kv through 196 kv, there's a single all-purpose Lapp POC-A* Bushing adaptable to transformer or circuit breaker use

Lapp

* Lapp POC-A means "Paper-Oil-Condenser-Adaptable." The introduction by Lapp of totally-enclosed paper-oil bushings brought the reliability and operating security of this bushing construction to equipment and systems at voltage ratings from 15 kv up.

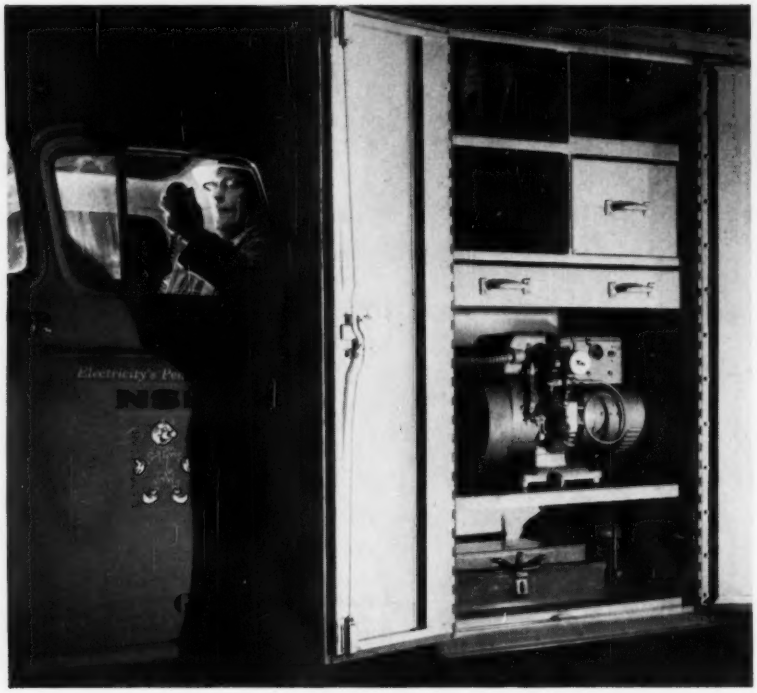
Now the POC design is modified to provide *adaptability*. At each voltage rating, the basic bushing has a hollow thick-wall conductor; interchangeable terminals provide for draw-lead *or* fixed-conductor service for transformer or circuit breaker use.

The new Lapp POC-A bushings conform to ASA standards (C76.1a-1958), and meet ASA dimensional requirements for several bushings in each voltage class. Also, flange adapters are available to provide for replacement of many pre-ASA bushings. Let us help you schedule a replacement bushing program that will greatly reduce your maintenance inventory.

Lapp Insulator Co., Inc., Le Roy, N. Y.

CIRCLE 87 ON READER SERVICE CARD

Onan NEWS REPORT



Built-in dual-purpose electric plant

delivers 2KW for tools and lights; keeps batteries fully charged, too!

Utility construction and maintenance trucks like this one, use two kinds of auxiliary electric power . . . and the Onan Electric Plant provides both. Workmen can plug in on the plant for 2,000 watts of 115-volt, 60-cycle A.C. to operate electric tools like drills, saws, soldering irons and floodlights. Or the plant will deliver 30 amperes of 12-volt D.C. to handle the battery drain of 2-way radio and battery-powered lights.

The Onan's D.C. output makes it unnecessary to run the truck engine to keep batteries charged, making savings in fuel and engine maintenance totaling hundreds of dollars per year per truck.

Leading body builders now install these dual-purpose Onan plants on new vehicles or you can mount them on vehicles now in service. Onan's Vacu-Flo cooling system permits installation within a closed compartment. Where no space is available in the truck body, the plant can be neatly installed over the cab within a handsome weatherproof steel housing.

Dual-purpose utility models are available with either 1,000 or 2,000 watts A.C. Powered by smooth-running single-cylinder Onan air-cooled gasoline engine.

ONAN INSTAPAC

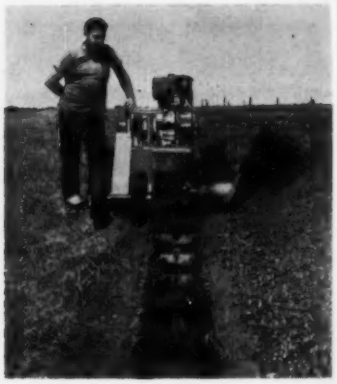
Instantaneous standby power for microwave systems. No interruption of any kind of signal. No moving parts. Can be fitted to existing standby installations.

Call the Onan distributor listed in your phone book or write for specifications.

D. W. ONAN & SONS INC.

ELECTRIC PLANTS GENERATORS ENGINES ENGINE-COMPRESSORS
2711 University Avenue S.E. • Minneapolis 14, Minnesota

Onan ELECTRIC PLANTS



Trencher . . .

. . . cuts trenches to 5-ft depths and 6-in. widths. The 12-hp model M-322 Ditch Witch is scaled up from the model M-3 to handle wider and deeper trenches and tougher digging conditions. The model 322 can dig ditches 5 ft deep, 4 in. wide; 4 ft deep, 6 in. wide; 3½ ft deep, 8 in. wide; 3 ft deep, 10 and 12 in. wide, in any soil.

Witch Marketing Co, 1959 W Fir Ave, Perry, Okla. (14)

Bondable Tapes . . .

. . . of silicone rubber are available in both supported and unsupported form. Because of their unusual sealing properties after curing, the tapes are ideal for use with electrical systems exposed to moisture, abrasives, or severe atmospheric contaminants. The supported tape is of three-layer construction, consisting of full-cured silicone rubber, woven glass cloth, and semi-cured silicone rubber.

General Electric Co, Schenectady 5, N. Y. (15)

Transformers . . .

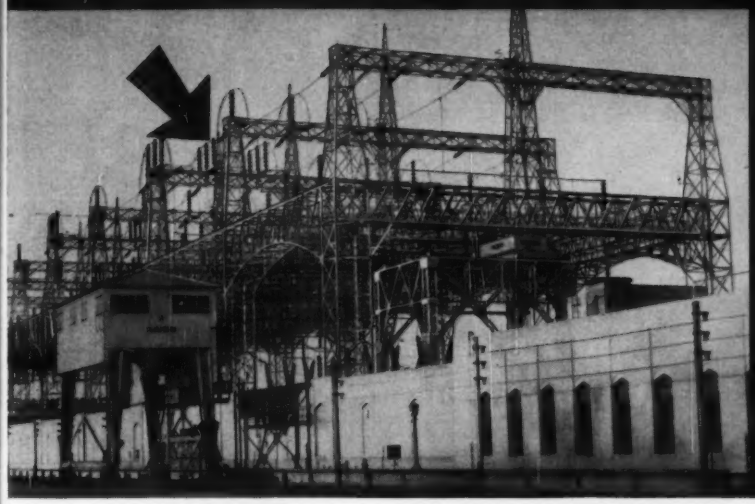
. . . in a new line of epoxy compound filled dry-type units feature quiet operation and small size. They are built in single-phase ratings 1 through 10 kva, 600 v and below. The wound-

(*Continued on page* 90)

REVOLUTIONARY NEW PAINT

CUTS MAINTENANCE COSTS

30% AND MORE!



VITA-VAR'S STAINLESS STEEL PAINT

Life Expectancy 12 Years or More!

Smooth Surface Resists Dirt and Soot!

Easy to Apply! Cuts Painting Costs!

Finish Becomes Brighter and Lighter!

Non Corrosive! Contains Stainless Steel Flakes!

VITA-VAR STAINLESS STEEL PAINT #13448 – A product of Vita-Var's Research Laboratory which co-operated with a large power company in the pioneering of its development – represents a significant advance in the durability of maintenance paints for steel and aged galvanized iron exposed to corrosive atmospheres.

THIS PAINT which contains a mixture of stainless steel flake (18% Cr., 8% Ni) and non-metallic pigments has successfully passed 8 years of extensive laboratory and field tests in corrosive areas.

FIELD TESTS on transmission towers recently inspected revealed that the paint showed no failure and retained its original freshness which indicates that it will afford protection for at least 12 years and probably more.

Investigate the superior advantages as compared to quality conventional paints! **LONG LASTING** due to protective qualities of stainless steel flake! **SMOOTH SURFACE** discourages dirt and soot deposits! **EASE OF APPLICATION** by brush, spray or roller coater reduces painting time! **MINIMUM CHALKING! METALLIC** appearance enhanced by aging, color becomes brighter and lighter! **LIFE EXPECTANCY**... 12 years or more!

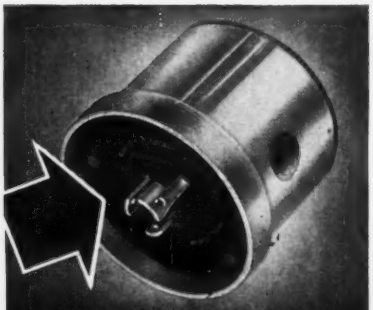
For further information, write to:

VITA-VAR CORPORATION

NEWARK 2, N. J. **Paint Engineers Since 1888**

CIRCLE 89 ON READER SERVICE CARD 89

announcing a development of major importance in TUBELESS controls...



EXCLUSIVE TERMINAL ISOLATION PREVENTS "ARC-OVER" TROUBLE

ANOTHER SUNSWITCH FIRST!

WRITE FOR DETAILS

Sun Switch DIVISION

RIPLEY COMPANY INC., MIDDLETOWN, CONN.

NAME _____

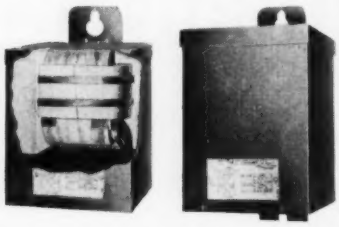
COMPANY _____

ADDRESS _____

Clip this coupon to your letterhead

Transformers . . .

(*Continued from page* 88)



core Form W element is covered with liquid epoxy resin, which hardens into a block of insulating material solidly encasing the core and coil assembly. Light in weight, the transformers require no fireproof vaults and can be mounted in any position.

Wagner Electric Corp, 6400 Plymouth Ave, St. Louis 14, Mo. (16)

First Aid Kit . . .

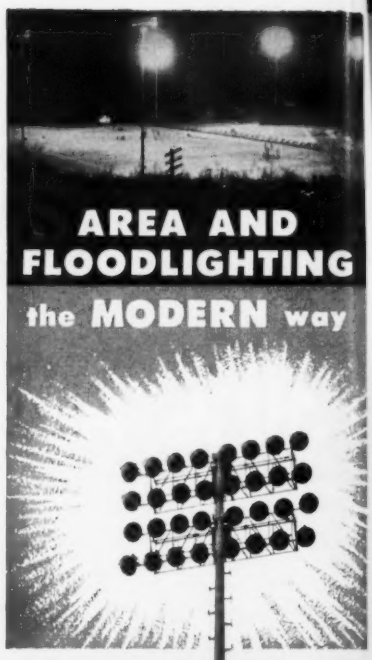
. . . has a transparent window in the cover for rapid inventory surveillance. A glance reveals the contents of individual cartons, each of which has a similar transparent window. Called the C-Thru series of first aid kits, the kits are designed for hanging on the wall.

Davis Emergency Equipment Co, Inc, 45 Halleck St, Newark 4, N. J. (17)

Measuring Wheel . . .

. . . can be rolled over irregular and uneven terrain. Called the Rolatape Model No. 415, the device has a wide neoprene tire

(*Continued on page* 94)

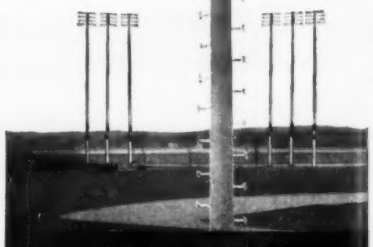


TULITO

TAPERED STEEL LIGHTING TUBES

For
- Baseball Diamonds
- Football Fields
- Playgrounds
- Shopping Centers
- Truck Terminals
- Railroad Yards
- Race Tracks
- Radio and TV Towers
- Transmission Power Lines

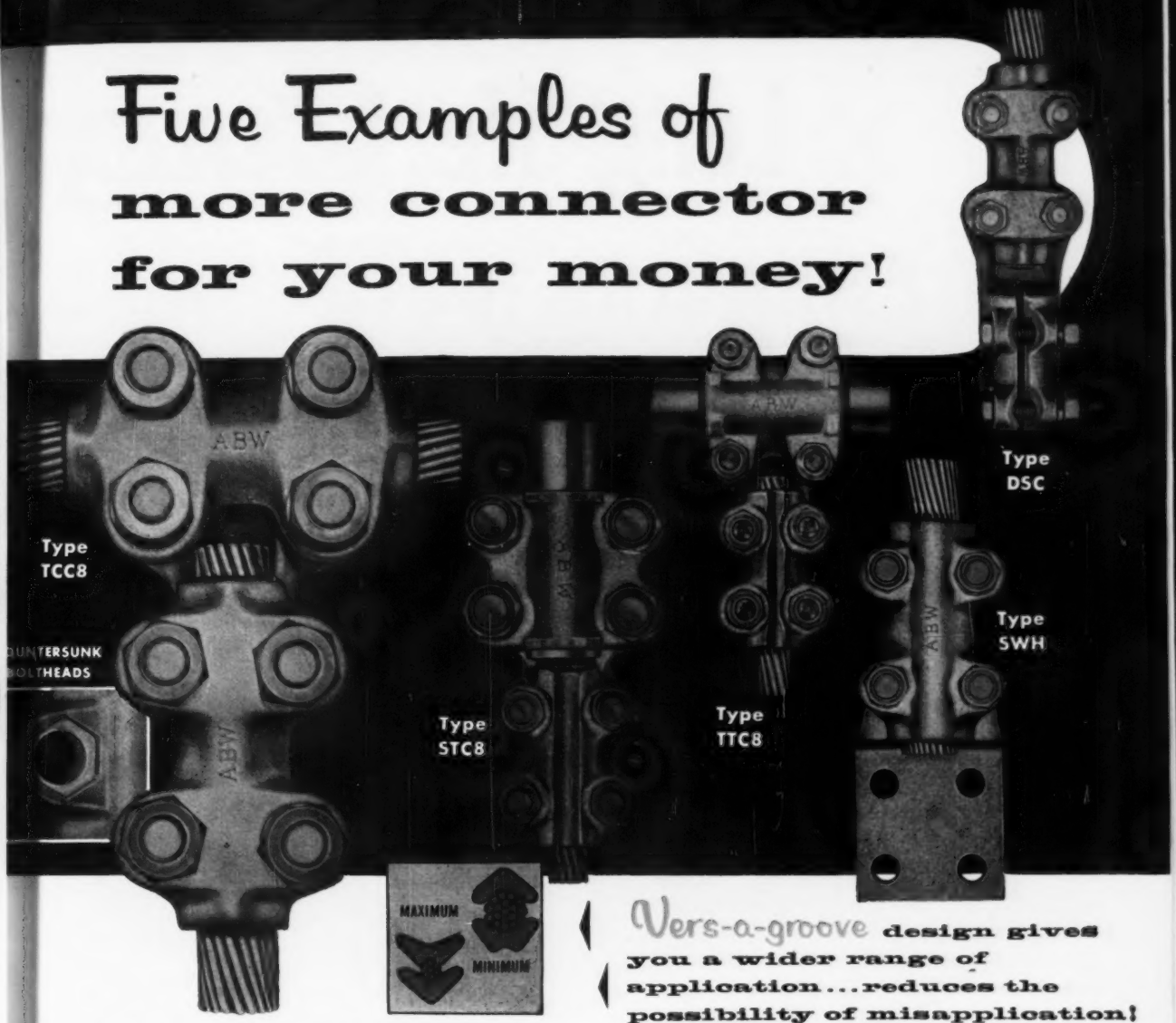
Engineered for Permanence, Strength and Safety...
Designed to accommodate from 2 to 40 lights.
Streamlined to enhance the appearance of any lighted area.



MEYER MACHINE, INC.

RED WING, MINNESOTA

Five Examples of more connector for your money!



Vers-a-groove design gives you a wider range of application... reduces the possibility of misapplication!

The 9 *stand-out features* of these Anderson Substation Connectors cannot be duplicated by any other connector line available. Look over these features carefully... *several manufacturers may claim some of them, but no connector line has them all!*

1. Two complete pairs of clamping bolts on both main and tap provide *extra insurance* against connector failure. *Most other designs have only six bolts.*
2. Higher clamping pressures with greater contact lengths *than in other standard connectors.*
3. Completely independent (3-piece) clamping on main and tap. Connection can be removed on one side without disturbing contacts on the other. *Most other connectors are two-piece.*
4. Conductor range practically eliminates mis-application and resulting connector "burn-downs". *Limited or no range of other connectors invite mis-application trouble.*
5. Wider conductor ranges permit considerable reduction in overall number of connectors which must be carried in inventory. *Two and three times greater inventory is required with other connectors.*
6. More connector for the money! More metal... 8 bolts instead of the ordinary 6 bolts!
7. One of the greatest advantages of these Anderson Vers-a-groove Tee Connectors is *ease of installation.* The 3-piece design, with independent clamping on main and tap, means that tap conductors may be bolted in on the ground and passed up to install over the bus runs. *Ordinary 6-bolt, 2-piece connectors much more cumbersome and difficult to handle.*
8. Cast surfaces which are inherently rough and tough mean positive electrical contacts. This feature plus the greater clamping strength of these connectors is a *distinct advantage in overall efficiency.*
9. The design of these connectors, by Anderson, has proved itself over more than 27 years of service under all conditions in all parts of the country. *Once used... tried and proved... no customer has ever switched back to an ordinary connector.*

For more complete information, including engineering and design data, performance characteristics and other particulars, consult your nearest Anderson Representative, or write to our home office.

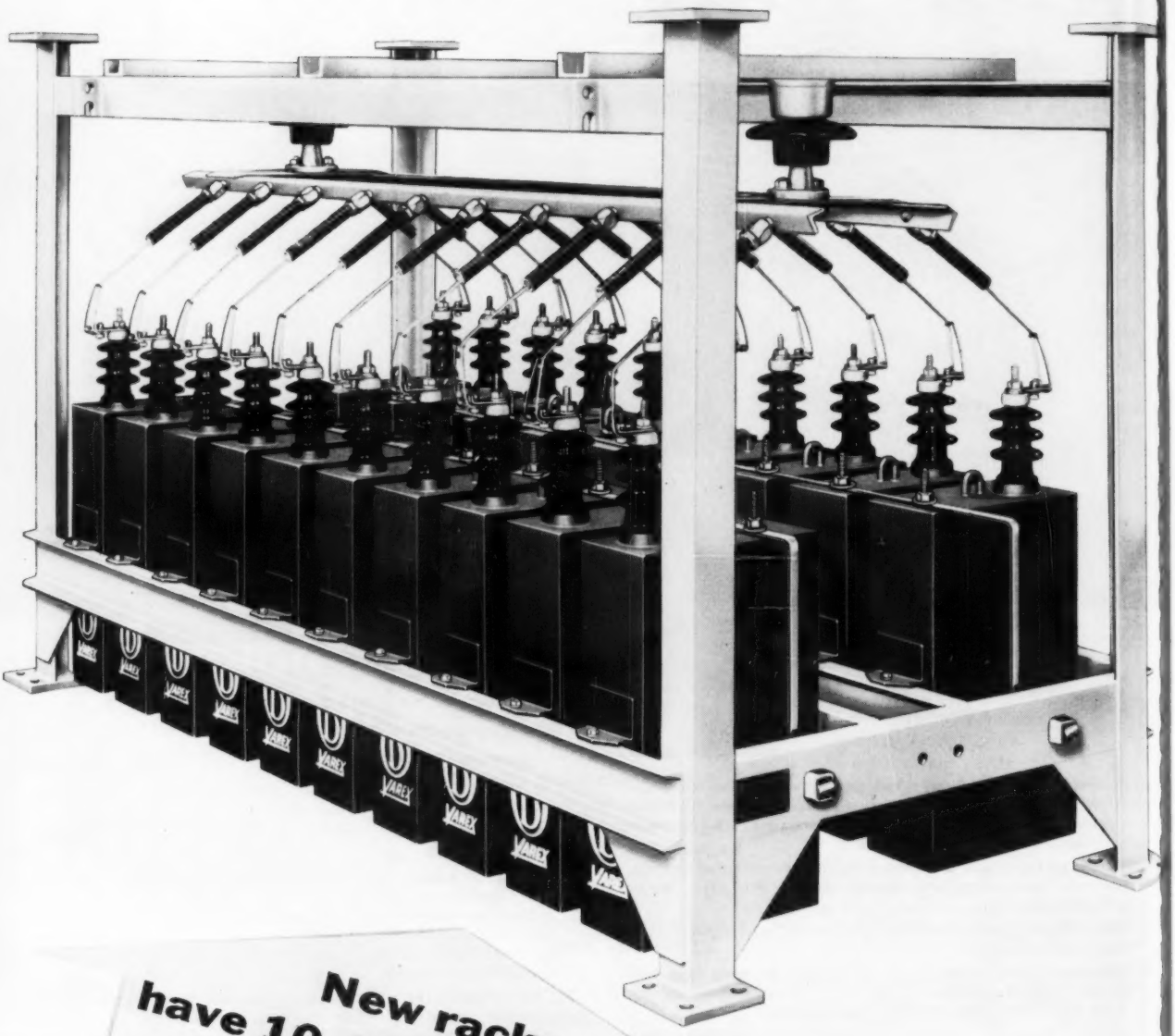
ANDERSON ELECTRIC CORPORATION • Birmingham 1, Alabama

ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

CIRCLE 91 ON READER SERVICE CARD

Long-life VAREX®



New racks have 10-15% less weight, require minimum maintenance

Varex racks are jig-welded with high-speed process that makes strong, neat joints, are less subject to distortion during handling than bolted, galvanized steel racks.

CIRCLE 92 ON READER SERVICE CARD

capacitors *NOW* come in long-life aluminum racks

Another long-life feature has been added to the O-B capacitor lineup. Varex equipment racks are offered for the first time in light, corrosion-resistant aluminum.

The many long-life features of Varex units - - among them low temperature rise, absence of tabs in the dielectric, stainless steel terminal studs - - have already proved successful in service. Containers are either stainless steel or mild steel finished with abrasion-resistant, epoxy-resin paint. Add maintenance-free aluminum racks to the package and you have equipments that you can install and forget.

The rack itself weighs 35 to 50 per cent less than the corresponding steel rack, depending on the type and size of the equipment. The equipment weighs 10 to 15 per cent less. Reduction in weight makes equipments easier to handle and decreases pole-loading for pole-mounted capacitors.

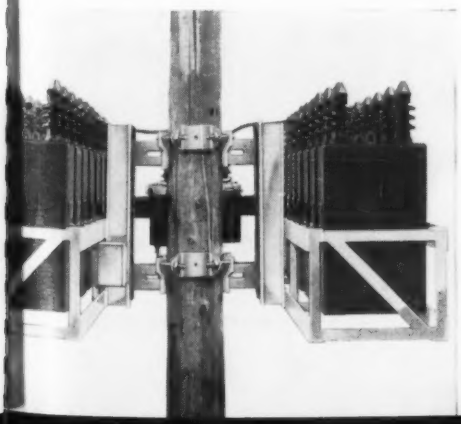
If you are on the growing list of satisfied Varex users, you'll like them even better in these new aluminum racks. Equipments are available for a wide range of voltage applications. Ask your O-B representative about them.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass (B) HOLAN

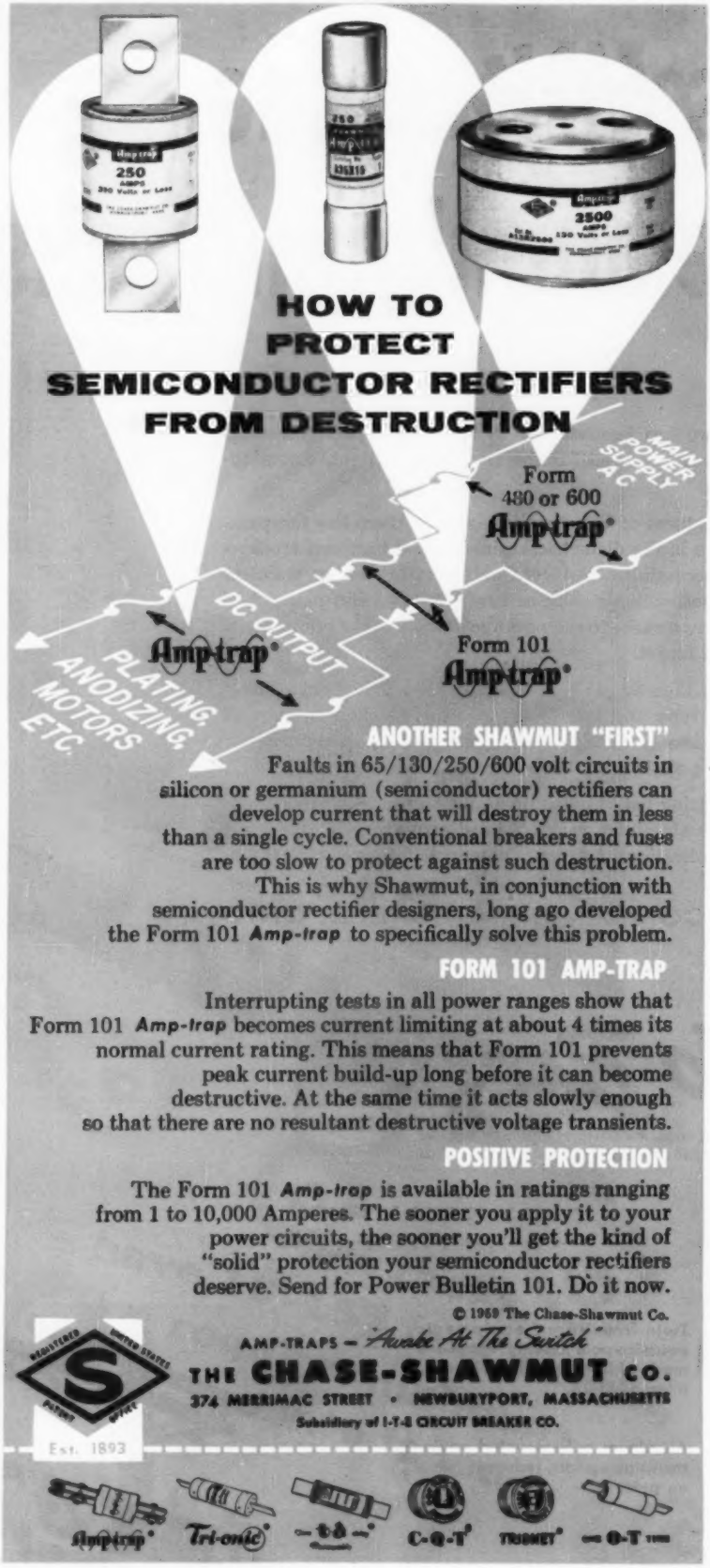
PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

4962-H



Twin-line Varex equipments equalize pole loading. Racks are made of light weight aluminum, alloy 6061-T6.

Aluminum pole-mounted equipments go up fast, reduce loading on pole.

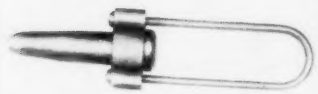

HOW TO PROTECT SEMICONDUCTOR RECTIFIERS FROM DESTRUCTION
MAIN POWER SUPPLY A.C.
Form 430 or 600 Amp-trap®
DC OUTPUT
PLATING, ANODIZING, MOTORS ETC.
Amp-trap®
Form 101 Amp-trap®
ANOTHER SHAWMUT "FIRST"
Faults in 65/130/250/600 volt circuits in silicon or germanium (semiconductor) rectifiers can develop current that will destroy them in less than a single cycle. Conventional breakers and fuses are too slow to protect against such destruction. This is why Shawmut, in conjunction with semiconductor rectifier designers, long ago developed the Form 101 Amp-trap to specifically solve this problem.
FORM 101 AMP-TRAP
Interrupting tests in all power ranges show that Form 101 Amp-trap becomes current limiting at about 4 times its normal current rating. This means that Form 101 prevents peak current build-up long before it can become destructive. At the same time it acts slowly enough so that there are no resultant destructive voltage transients.
POSITIVE PROTECTION
The Form 101 Amp-trap is available in ratings ranging from 1 to 10,000 Amperes. The sooner you apply it to your power circuits, the sooner you'll get the kind of "solid" protection your semiconductor rectifiers deserve. Send for Power Bulletin 101. Do it now.
© 1959 The Chase-Shawmut Co.
AMP-TRAPS – "Awake At The Switch"
THE CHASE-SHAWMUT CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS
Subsidiary of I-T-E CIRCUIT BREAKER CO.
Est. 1893
Amp-trap® Tri-onic® C-Q-T® TRIONIC® O-T

Measuring Wheel . . .

(*Continued from page* 90)

that provides positive traction under all conditions. It measures to ½ in. on one side of the disk wheel and tenths of a foot on the other. One man can roll it to measure up to 100,000 ft.

Rolatape, Inc, 1741 14th St, Santa Monica, Cal. (18)



Deadend . . .

. . . for all standard sizes of Alumoweld, aluminum clad steel messenger, static wire or guy strand. The "GDEA Series" maintains 95% or better of the strength of Alumoweld with extra-long aluminum jaws. The one-piece jaws are of high strength aluminum alloy and are designed to hold on the aluminum coating of the conductor and not puncture through to the steel. The deadends are distributed by Line Material Industries, Milwaukee, Wisconsin.

Fargo Mfg Co, Inc, 845 Main St, Poughkeepsie, N. Y. (19)

Adapter . . .

. . . simplifies photoelectric control mounting on round or fluted ornamental poles. The S-485

(*Continued on page* 96)

GOOD NEWS in aluminum construction . . .

ALUMOWELD

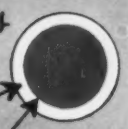
Aluminum-Covered Steel Wire and Strand

Alumoweld was developed to cut costs and improve performance of overhead ground wire, ACSR conductors, guy and messenger strand. Its thick aluminum covering —25% by area—gives Alumoweld corrosion resistance equal to solid aluminum wire and 33% of the electrical conductivity.

When used as overhead ground wire, remember that Alumoweld is just as strong as steel, is 18% lighter in weight, and has 3 times the conductivity. These advantages permit greater mid-span clearance, and make Alumoweld excellent for relaying and for discharging lightning currents to ground. For guys and messengers, Alumoweld Strand provides the full strength of steel and will last far longer.

These valuable properties also pay off when Alumoweld is used as core wire for ACSR conductors. Here, Alumoweld eliminates the hazard of dissimilar metals in contact, provides increased conductivity and gives you an extra-high-strength core wire that matches the life of the solid aluminum wires. For the complete story, send for Bulletin E.D. 3000.

Two Exclusive features of ALUMOWELD



Alumoweld's thick aluminum covering will never crack, flake or peel. Applied by an entirely new cladding process—the controlled atomic weld —the heavy aluminum covering and the high-strength steel core are inseparably interlocked by a ductile weld that remains permanent under all operating conditions.

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION, GLASSPORT, PA.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

New from PENGO

...a tensioner you can carry in every line truck!

The most mobile of all PENGO tensioners, the 4000 PM can be hauled on any line truck or pickup. It features two 18-inch diameter Neoprene-lined magnesium bullwheels for stringing any size conductor up through .750-inch diameter. This includes ACSR to 336, 400 CM or 397,500 CM in AAC. With its 11-inch Tru-stop disc brake, the 4000 PM will pay out smoothly under continuous working tensions up to 1000 lbs.

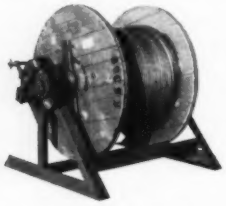
Any type power now employed may be used for pulling, such as collapsible reel attached to a winch shaft.

The tensioner includes a base plate for leaning against the pole. One man holds up the unit while another places a chain around the pole with a bolt and large wing nut tightener to hold it in place. The unit will not slide around the pole even under maximum tension. Conductor can be payed off any reel stand (such as the PENGO 4100 shown) or other device with sufficient drag to prevent overrun of the cable between the reel and the bullwheel input groove.

Input fairlead swings to either side, permitting stringing in either direction. This gives complete flexibility in alleys and other areas with obstructions such as walls and fences on one side of the pole. Extreme care has been taken to make the PENGO 4000 PM Pole Mount Tensioner useful under every conceivable condition.

4000 PM Specifications

Overall Length	31½"
Overall Width	15"
Overall Height	40½"
Approx. Weight	165 lbs.
Bullwheel OD	18"
Bullwheel Groove Diam.	.750 (19 mm)
Working Tensions	to 1000 lbs.



PENGO Model 4100 Reel Stand

Handles reels to 48" in diameter by 34" wide. Equipped with same spindle brake assembly used on all PENGO Reel Stands; includes PENGO lifting yokes for easy reel changing. Ideal for paying out conductor to the 4000 PM tensioner.

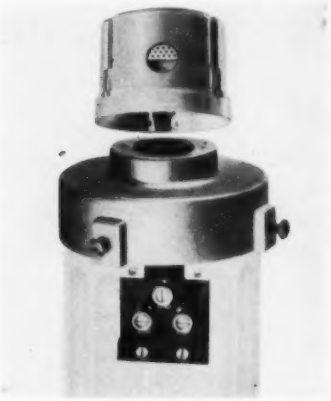
B-9

TENSION WIRE STRINGING is far safer, saves you plenty of time and money. Why not get the facts today? PENGO offers job-tested equipment for any size conductor, for all stringing conditions. Write for new PENGO Catalog TWS-1. Address Dept. G-9.

PETERSEN
ENGINEERING CO., INC.
Santa Clara, California
Phone AXminister 6-7712

Adapter . . .

(*Continued from page 94*)



pole top adapter conforms to EEI specification TDJ-148 and NEMA specification SH-18-1959. It will fit any ornamental pole, round or fluted, up to 4½ in. outside diameter. Terminals take up to No. 8 stranded wire.
Fisher-Pierce Co, 170 Pearl St, S Braintree 85, Mass. (20)

Bolt Threader . . .

. . . has only one die head for all ¼, 5/16, ⅜, 7/16, ½, 9/16, ⅝, ¾, ⅞ and 1-in. bolt dies. A set of 4 full-width dies of desired size are easily inserted in die head. Loosening of locking lever gives quick, foolproof setting of size bar for standard, over or undersized thread. It is known as The Ridgid No. 101.
Ridge Tool Co, Elyria, Ohio. (21)

NOW...
TROUBLE-SHOOT TROUBLE SPOTS *FAST*
Save valuable Kw-hrs.

DICE MICROHM METER

Favorite of leading utilities for all low-resistance measurements on material tests, circuit breaker contacts, bus bar connections, cable joints.
MEASURES DOWN TO *ONE* MICROHM!
J.W. DICE CO. ENGLEWOOD, N.J.

First choice of
THOSE WHO BUY THEM...

WESTERN RED CEDAR POLES

Preferred by
THOSE WHO CLIMB THEM...

Nature's finest . . . Western Red Cedar Poles are uniform, lightweight, safer, straighter, sturdier . . . *clean to climb.*

Positive protection against age, weather and fungi by the Thermal Process with PENTAchlorophenol (to EEI or AWPA specifications). Western Red Cedar Poles are immune to disease, rot and deterioration. Pole life is unsurpassed . . . yearly pole-line maintenance negligible.

Avoid Expensive Replacement Costs
Insist on...

WESTERN RED CEDAR POLES
Thermal Processed with
PENTAchlorophenol

For prompt delivery and service **ORDER** *from these members of the*

WESTERN RED and NORTHERN WHITE CEDAR ASSOCIATION

VALENTINE CLARK CORPORATION
ST. PAUL 8, MINNESOTA

BELL LUMBER & POLE COMPANY
MINNEAPOLIS 1, MINNESOTA

B. J. CARNEY CO.
MINNEAPOLIS 3, MINNESOTA
and
SPOKANE 1, WASHINGTON

CEDAR SERVICE, INC.
MINNEAPOLIS 40, MINNESOTA

R. G. HALEY CO.
TOLEDO 4, OHIO

JOSLYN MFG. & SUPPLY CO.
CHICAGO 6, ILLINOIS

MacGILLIS & GIBBS CO.
MILWAUKEE 9, WISCONSIN

PAGE & HILL, INC.
MINNEAPOLIS 3, MINNESOTA

SCHAEFER-HITCHCOCK CO.
SANDPOINT, IDAHO

THEN
.. and NOW
Since 1950, Southwire has grown from 10,000 to 250,000 square feet—an independent wire and cable manufacturer with skilled manpower to match the most modern equipment available.
SOME THINGS NEVER CHANGE AT SOUTHWIRE

Sure, a fellow may have to walk a little farther from his car to the plant, or use the telephone to get information instead of stepping into the next office for it — but at heart we're still a small plant in a small town, waiting anxiously for each order and eagerly watching its progress through the mill with care and pride.

We're still Jim, and Jack, and Dave, and Pete—to our customers and to each other. The order for a thousand pounds of copper wire is still important to us. And it gets the same personal attention as one for a million and a half pounds of ACSR transmission cable.

True, constantly expanding product lines, larger and more modern facilities, and continuing research programs, are added reasons for doing business with SOUTHWIRE . . . but personal attention, dependable service, and quality products, are the things that have built our business and will continue to make SOUTHWIRE a good place to trade.

SOUTHWIRE serves the world

Southwire® Company

TErrace 2-6311 CARROLLTON, GEORGIA

• Bare and Weatherproof Copper and Aluminum Line Wire • Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper Aluminum and Triplex • U.R.C. (DBWP, TBWP) Copper • Copperweld® Conductors • Copper and Aluminum Building Wire • ACSR and All Aluminum Cable • Galvanized Steel Guy Strand and Static Wire • Aluminized Steel Guy Strand and Static Wire • Aluminum Alloy Wire • Cable Accessories • NM Sheathed Cable

ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

MAJOR INNOVATION in the centralized meter shop is the use of power and gravity conveyors. Untested meters arrive on the overhead gravity conveyor. They travel to the demand repair area on the two-deck conveyor

Production Line Shop Aids Meter Tests

Centralized test facility allows a five-man staff to handle 17,000 meters annually. Meter stock will be reduced by 50%

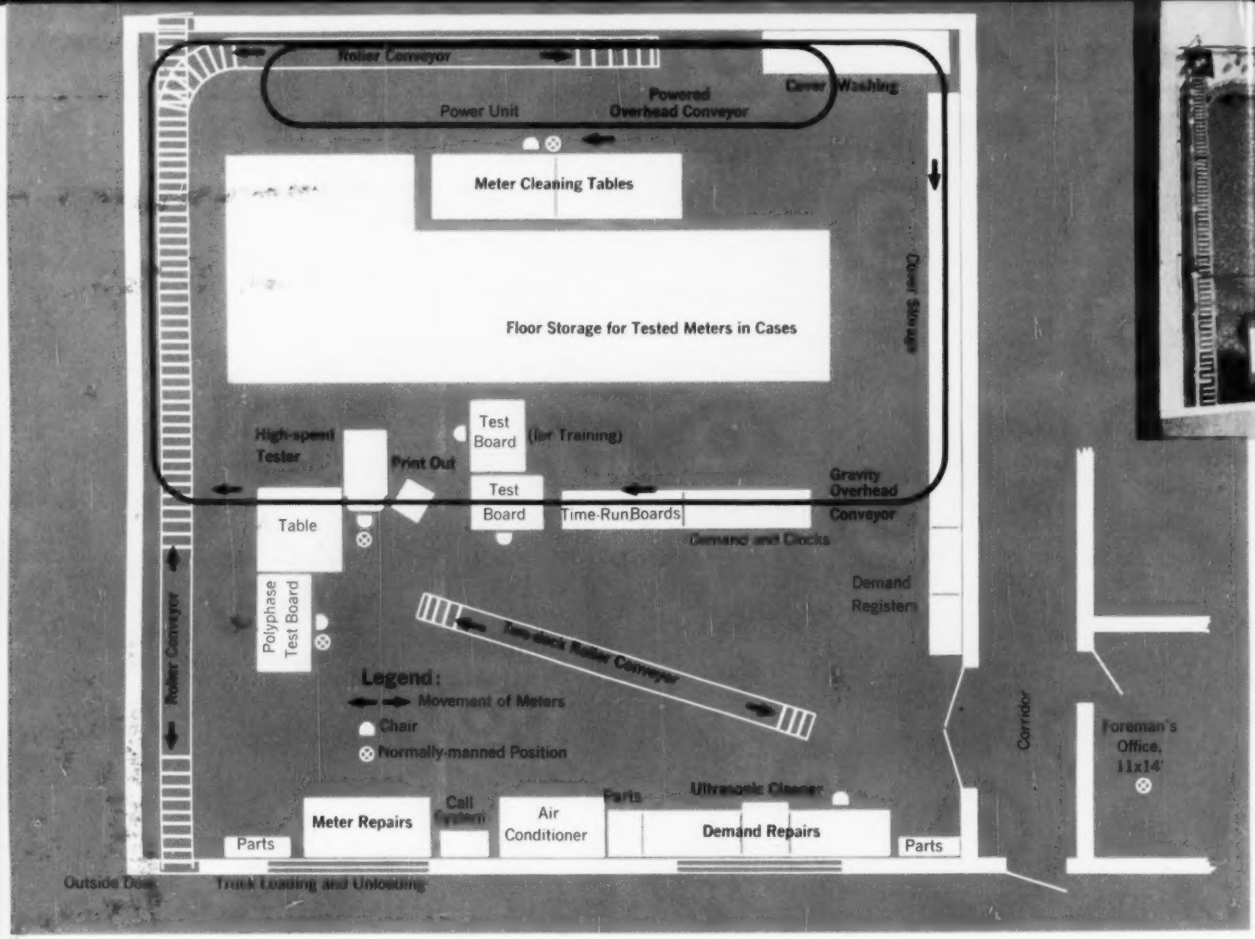
***FRED AUSTIN**, Meter Engineer, Public Service Co of New Hampshire, Manchester, N. H.*

Public Service Co of New Hampshire centralized its meter testing and maintenance operation at Hooksett, near its Manchester headquarters, late last year. An exhaustive study indicated that considerable savings could be realized through a reduction in manpower and meter parts as well as in overall meter stock.

Prior to centralization 14 full-time men were needed at 15 locations to test and maintain 17,000 meters annually as required under present state commission regulations. After six months of operation the predicted saving in manpower has been accomplished and reduction in meter stock is well under way. The same work now is being handled by a five-man staff, including personnel for handling meter transportation to and from the company's districts. There are 200,000 meters on company lines, of which 27,000 are off-peak meters and 15,000 mechanical demand meters.

Formerly Public Service was operating with a 4% stock. The new program calls for testing meters one day and putting them back into service the next in new locations. By the end of this year the expected 2% stock should be realized.

Some components in the Public Service shop possess features which are believed to be unique and



thus may be most helpful to utilities studying central testing. Three particular innovations are: (1) a method of exhausting toxic fumes from two-stage ultrasonic cleaning and rinsing equipment; (2) "power" and "free" overhead conveyors; and (3) a meter-carrying case developed by the company.

Nucleus of the shop is a high-speed electronic test board with automatic sequencing and accuracy print out. This board tests 70-80 meters per day. These consist of "as found" tests on demand and off-peak meters which later will be returned for an "as left" check; "as found" checks on meters to be junked; and as the largest part of the testing, adjustment of meters to be returned to the packing bench.

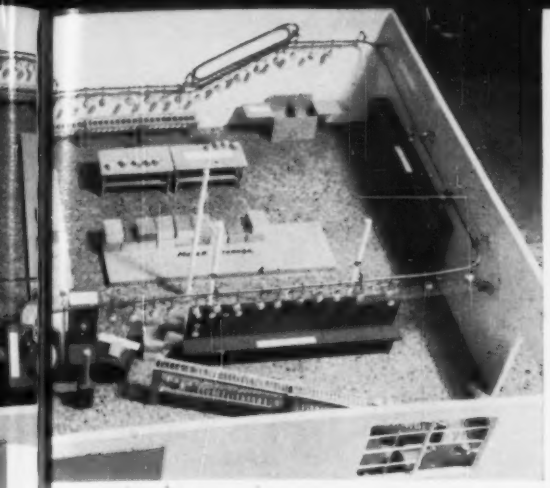
A general laboratory and test panel is utilized in testing ammeters, voltmeters and watt-hour meters. Measurements are made using current and potential instrument transformers. Single-range instruments consist of an ammeter, a voltmeter and a watt-hour meter. At this panel the instruments are mounted in a drawer below the bench top and are viewed through a transparent section of the bench top.

Current is continuously adjustable to 100 amp maximum; potentials of 120, 240 and 600 v are supplied, the latter with vernier adjustment. Provision is made for correcting the phase angle. An automatic photoelectric revolution counter is provided for making measurements on watt-hour meters. These measurements can be made either with instruments in the panel or with an external watt-hour standard.

Shop Has Three Innovations

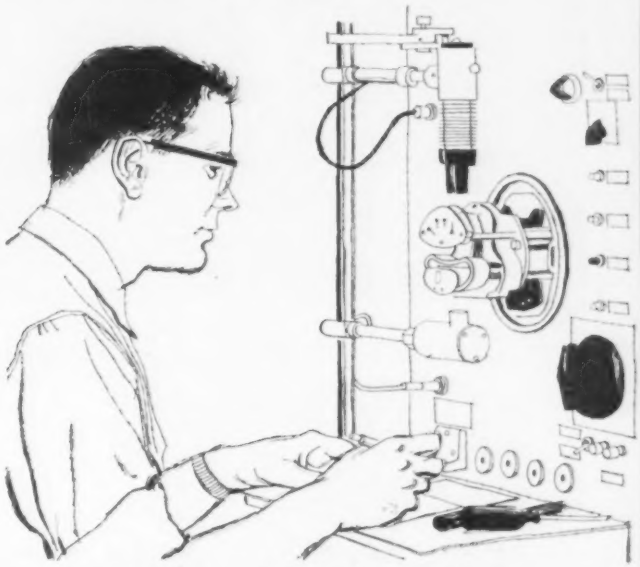
To exhaust fumes from the ultrasonic cleaner, a hood was designed to fit over the top of the cleaner. Sides of the hood are of metal; the top is glass. The front of the hood is an aluminum double-window sash which slides up and down for access to the cleaner. The complete enclosure is exhausted by a small powered fan. This provides a fume-exhausting system which does not affect air conditioning in the summer or heating in the winter. The two-stage ultrasonic cleaner and rinser contribute greatly to quantity maintenance of demand registers and off-peak meters.

In place of the usual continuous powered conveyor, a "power" and "free" conveyor system is used. Meters are elevated by a loop in the overhead conveyor by power. Then they are released



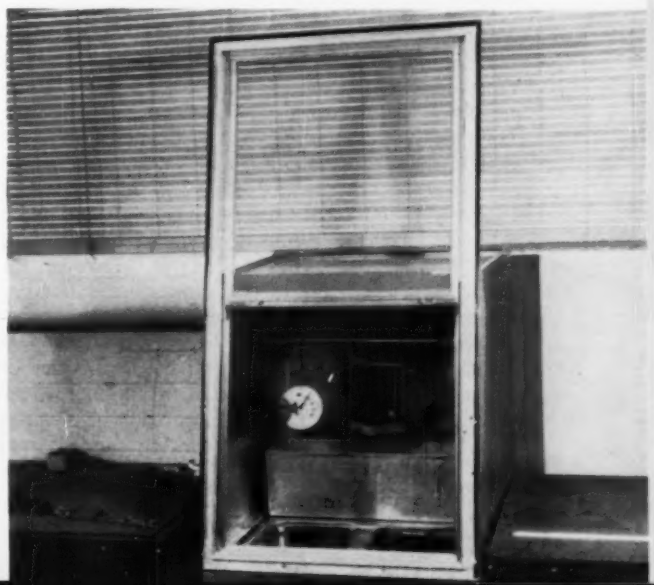
PROPOSED LAYOUT of conveyors was studied through the use of a shop model (scale 1 in. per ft). The resulting plan of the test facility provides sufficient space for test locations, storage areas, and laboratory training. A five-man staff handles the testing and distribution to the districts of 17,000 meters annually

FIBRE CASES carry four to six meters safely on lengths of webbing into and out of the meter test shop



NUCLEUS OF THE SHOP is high-speed tester with automatic sequencing and printout for 70-80 meters daily

EXHAUST HOOD over ultrasonic cleaner consists of metal sides and a aluminum-frame window for access



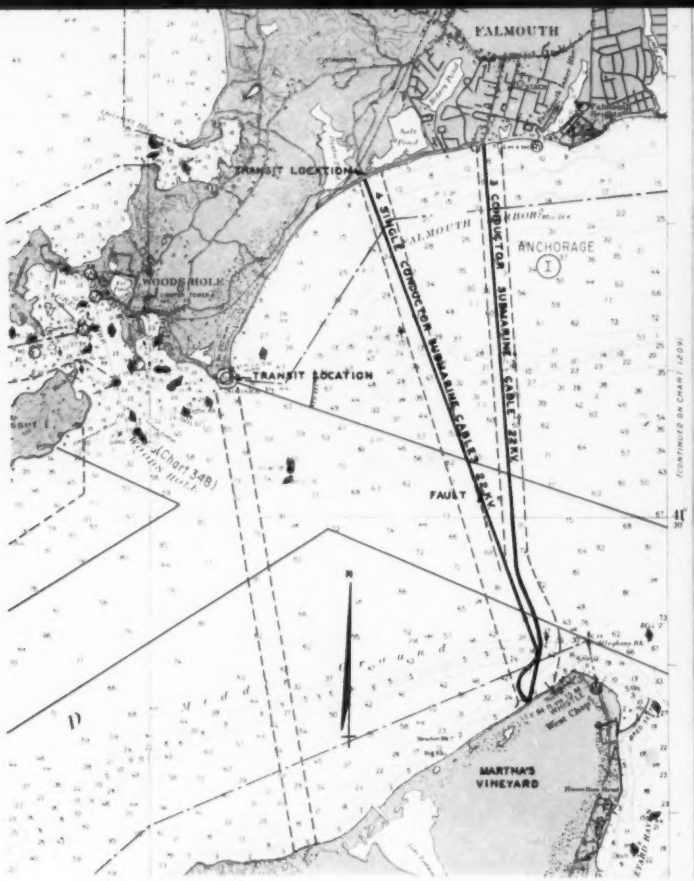
to run by gravity to the test station and thence back to the packing bench. The power conveyor is driven by a ½-hp motor. A stop at the high-speed test board allows the operator to release one carriage at a time, with another coming into place.

A two-deck gravity roller conveyor carries meters back and forth between the high-speed test station and the demand repair area. Gravity roller conveyors are used to carry untested meters in packing cases to the low point of the power conveyor; the same roller conveyors are used to carry tested and packed meters back to the truck loading platform. Use of the gravity overhead conveyor allows advantageous use of the wall area to store a half-day's work load of untested meters. Meters held in this easily-seen position help furnish the impetus for the desired production rate.

The method of handling meters in the meter truck, which periodically stops at all districts, and the handling of meters into and out of the new shop was given considerable thought. The need was for a low-cost, rugged case that would carry all types of meters safely and conveniently. To meet this need, Public Service designed a fibre case with card holder and handles. Each meter gets a "hammock ride" in a length of webbing. Each case will hold six single-phase socket or A-base meters, four demand or off-peak meters, A or S-base, or four polyphase meters with demand attachments.

Wooden cleats on the bottom of each case, essential to roller conveyor operation, also serve as guides for stacking cases. Alnico permanent magnets are used as buffers to prevent shocks from collisions between cases in transit on the conveyors.

Small test boards are used for training purposes. The air-conditioned shop also supports the usual glass-cover washer as well as work benches and time-run boards.



SUBMARINE CABLES across Vineyard Sound were checked by skin divers who covered about two miles per day in 40-ft depths and one-half mile per day in deeper water. Divers used underwater cameras

Skin Divers Patrol 25-Kv Submarine Cables

L. L. **RAYMENT**, *Assistant Electrical Engineer, Cape & Vinyard Electric Co, Hyannis, Mass.*

Cape & Vineyard Electric Co has successfully used skin divers to patrol submarine cables across Vineyard Sound from Falmouth, Mass., to Martha's Vineyard. It was possible to patrol up to two miles per day in depths up to 40 ft and one-half mile per day in deeper water, where decompression is required after 35 min exposure.

Working conditions for divers in this section of Vineyard Sound are extremely difficult. Water depth varies up to 90 ft and tidal currents are three to four knots directly across the cable course. However, the divers, swimming just off the bottom, did not encounter much difficulty with current. This was especially true in deeper water.

Visibility was 20 to 30 ft with no disturbance of sand or silt, which occurs when conventional divers walk across the bottom. In the few areas where cables were lightly buried in loose shifting sand it was possible to follow the path of the energized conductors by observing the erratic behavior of the diver's compass.

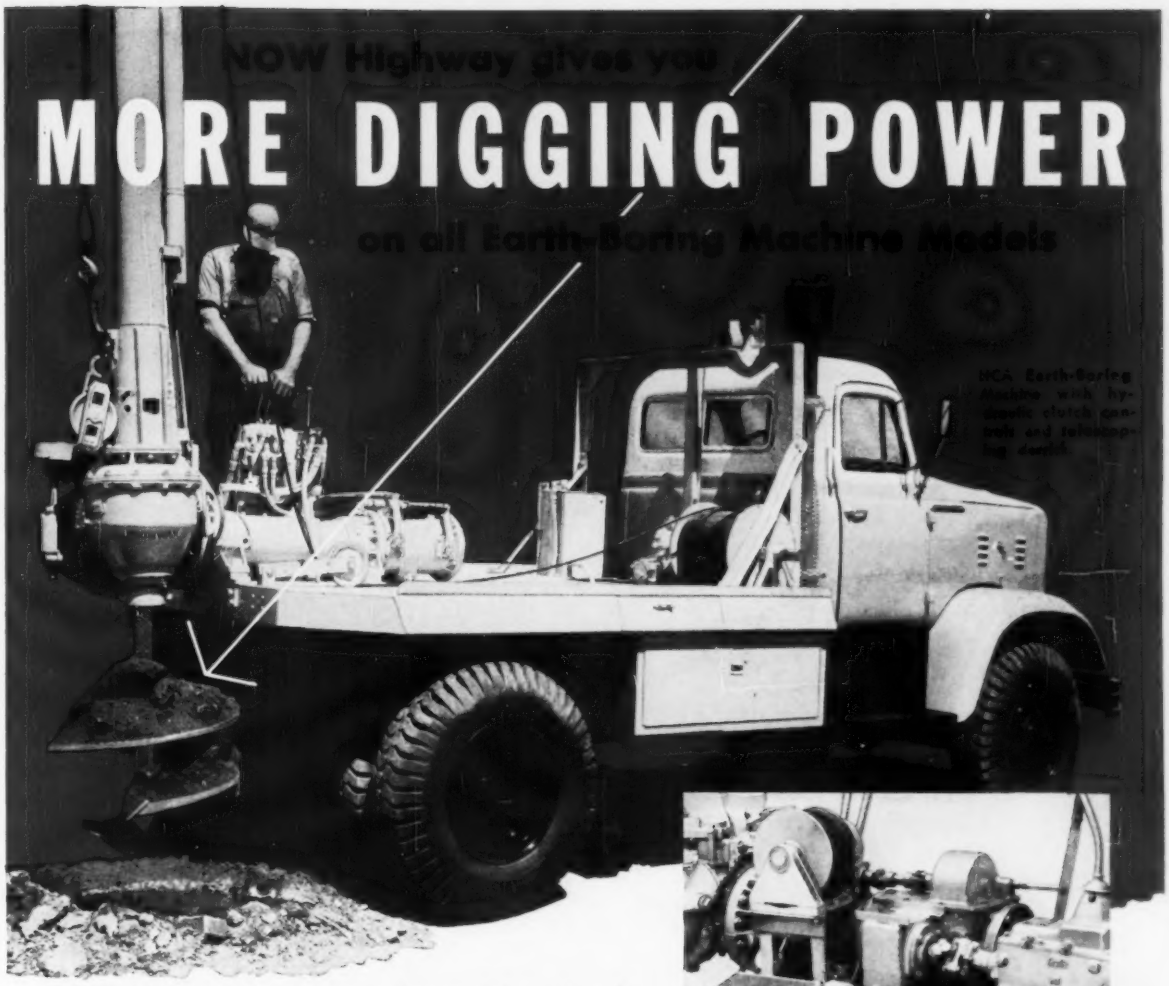
Much worthwhile information was obtained from the patrol. Some photographs were taken both with still and movie underwater cameras. A recently-developed flash attachment is now available and should greatly improve results.

The cable, one of two supplying Martha's Vineyard from the mainland, comprises four 2/0 paper and lead armored conductors and operates at 25 kv. The fourth or spare conductor is normally energized and connected in parallel with the No. 2 phase.

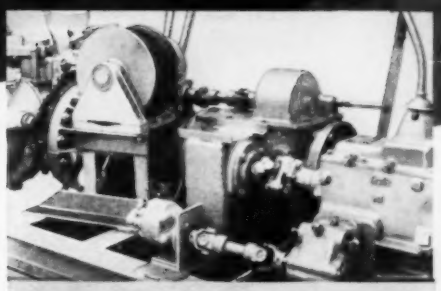
The divers removed several small anchors from the cables, but no serious damage had been inflicted. An interesting sidelight of the patrol was the discovery of a wrecked aircraft, probably of World War II vintage.

NOW Highway gives you MORE DIGGING POWER

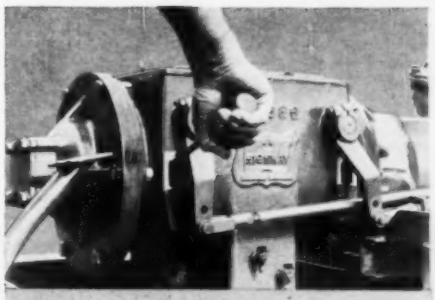
on all Earth-Boring Machine Models



HCA Earth-Boring Machine with hydraulic clutch controls and telescoping derrick



Integral Winch takes power directly from the transmission and allows all speeds of transmission to be used.



The new Highway adjustable clutch provides more speed and more power. Easy field adjustment saves you costly downtime and shop maintenance. Stronger shift shafts give more pressure on the clutch with less control pressure.

NOW! Heavy-duty adjustable clutch and integral winch on all skid-mounted and truck-mounted diggers

Now Highway gives additional digging power on all its earth-boring machine models for fast, easy digging in any soil. The HDA and HCA models derive their power from the truck engine and permit holes to be dug in all truck transmission speeds. Mount on any vehicle with sufficient capacity to handle the weight and operate the machine. Highway earth-boring machines are available in sizes to dig holes up to 36" in diameter and to an average depth of ten feet. Available with manual or hydraulic clutch controls. Find out how Highway's earth-boring machines can save you time and money. See your Highway representative now — or write directly to Highway Trailer Company for illustrated brochure.

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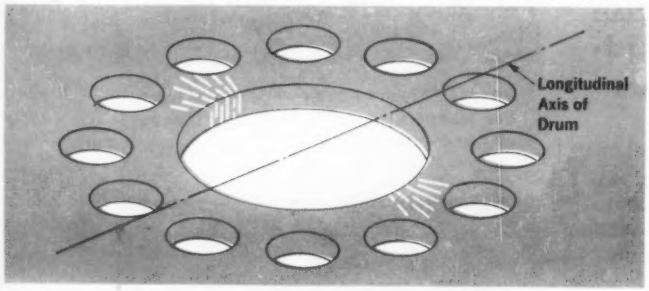
HIGHWAY

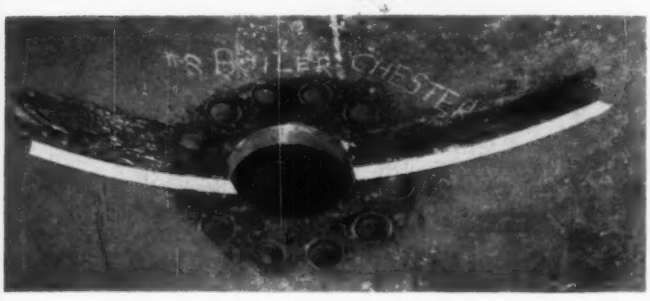
CIRCLE 103 ON READER SERVICE CARD 103

ORIGINAL EXTENSIONS to downcomer tubes supplying water walls of a Stirling boiler produced a stratified condition resulting in a low-temperature water layer in the lower part of the drum

Bent Tube Extensions Stop Drum Cracking



SURFACE DEFECTS at blowdown valve openings were found by fluorescent particle inspection (above). Repairs were made using an 80,000-psi tensile rod (below)



J. J. ***HARPER****, Supt, Mechanical Maintenance, Philadelphia Electric Co, Philadelphia, Pa.*

Bent tube extensions have eliminated cracking at blowdown valve openings in lower drums of Stirling boilers used for peaking capacity on the Philadelphia Electric Co system. These tube extensions draw cooler water from the lower portion of the drum and reduce the temperature differential across the drum, which was as high as 300 F, to a maximum of about 85 F.

Isolation of the cause of cracking at the blow-down openings followed metallurigical tests that indicated the failure was due to stress corrosion. Cracking was transcrystalline in nature, penetrating the steel perpendicularly to the surface. No evidence of intercrystalline cracking or caustic embrittlement was found. Inspection of the duty-cycle of the boilers showed they were passing through temperature cycles frequently in meeting peak loads. Further investigation revealed that the drum was being stressed thermally due to temperature stratification.

One boiler opened for repairs was found to have been fitted initially with straight tube extensions to the downcomer tubes supplying the water walls. This arrangement produced a stratified condition resulting

(*Continued on page* 106)

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Section of Roebel bar for 22,000 Volt, 76,000 KVA turbogenerator stator.

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NECCOBOND...solid insulation bonded to the copper provides longer life, greater strength and stability

In NECCOBOND, National has developed a complete insulation system, using mica, glass and a special impregnant. Its particular advantages for high voltage coils are:

- Exceptional thermal stability.
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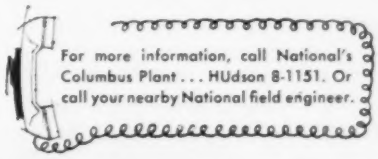
NECCOBOND is based on time-proven insulating materials – mica and glass. These are welded by a special impregnant into a tenaciously bonded, resilient, voidless insulation wall. A unique method of fabrication assures homogeneous insulation.

When replacing high voltage coils, investigate the long term savings with NECCOBOND. You'll find our advice impartial–we offer all types of insulation.



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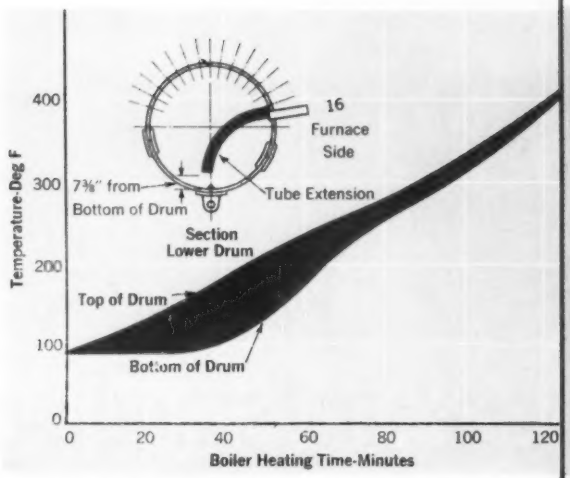
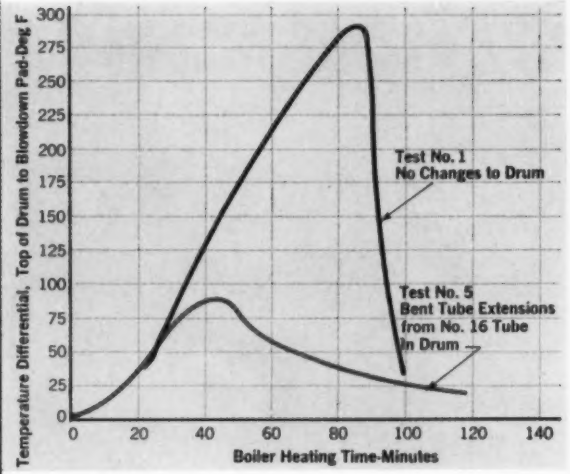
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

CIRCLE 105 ON READER SERVICE CARD 105



BENT TUBE EXTENSIONS drawing water from the lower drum during start-up held maximum differential to 85 F



TWO TESTS show effect of tube extensions. Other tests showed that extended start-up time had little effect

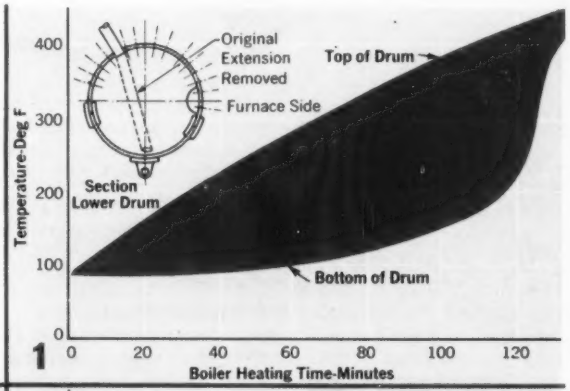
in a low-temperature water layer in the lower 14 in. of the drum. This stratification persisted even though the top layer approached saturation temperature, resulting in a temperature differential of 300 F. Removal of these initial extensions did not materially alleviate the condition.

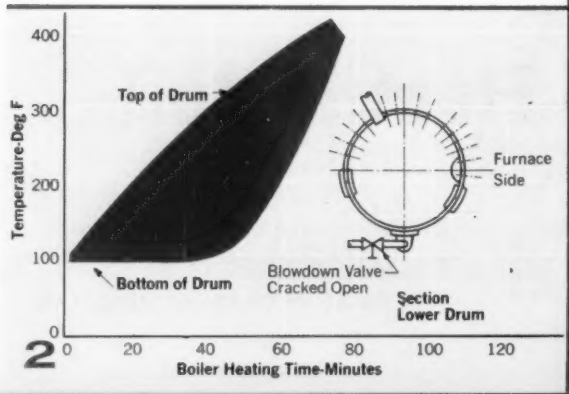
Among the methods tried was the installation of bent tube extensions onto the front row of tubes nearest the furnace. These extensions draw cooler water from the lowest portion of the drum during start-up. The maximum demand for water during start-up in the first row of generating tubes is sufficient to displace the layer of cooler water in the lower part of the drum. This provides a more nearly uniform temperature in the drum, the maximum difference being about 85 F. This installation was the solution to attaining lower temperature differentials in the lower drums.

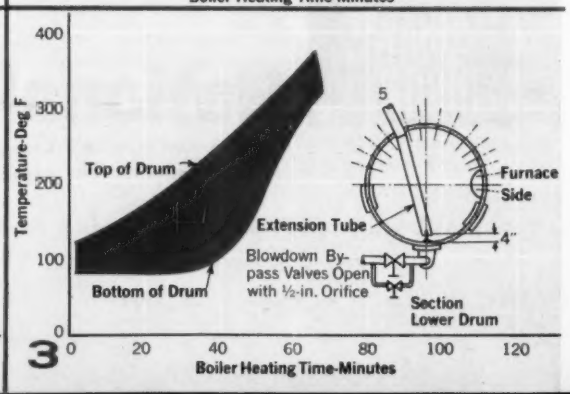
Tube extensions now are being added to the lower drums in all Stirling boilers on the system, which are experiencing more frequent start-ups as the older units assume more of the peaking responsibility.

Results of Other Methods . . .

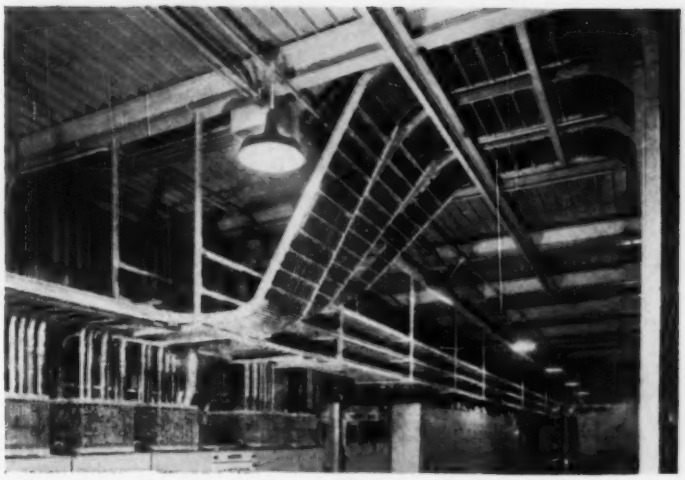
Prior to the use of bent tube extensions, other methods to reduce the maximum temperature differential in the lower drum included removal of original tube extensions. (1) Although the maximum differential then did not exceed 240 F, the point of stratification was lowered and could have induced a higher stress in the lower part of the drum. Draining of the cooler water during start-up (2) reduced the differential but required additional make-up. Extensions connected to a row of tubes definitely established as downcomers (3) was not successful.



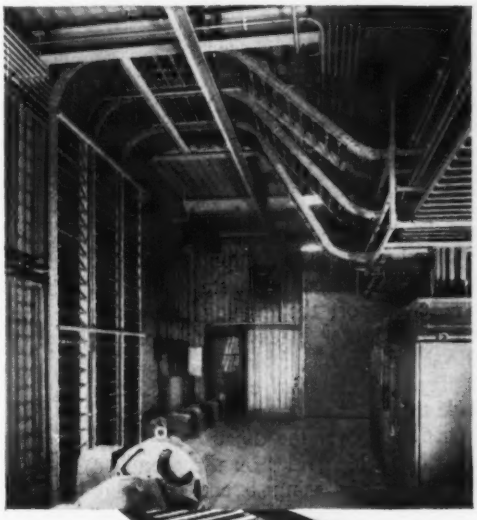


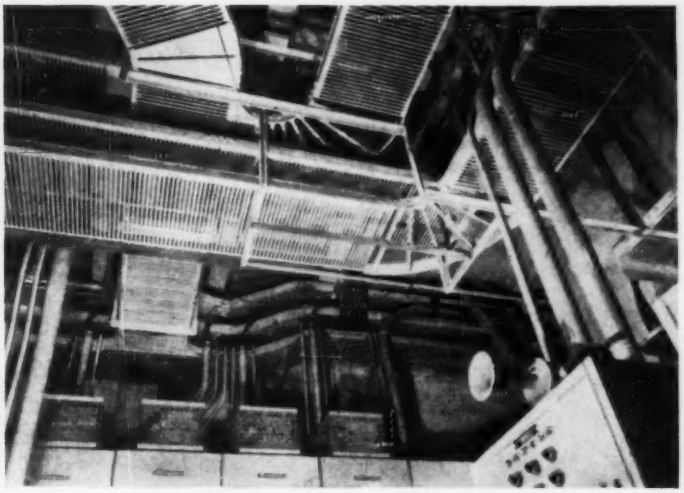


how INLAND STEEL uses GLOBE INTERCHANGEABLE TRAYS to support cables in their Indiana Harbor Plant



★ Engineered for Uniform Design and Easy Installation
★ Steel or Aluminum Construction
★ Complete Accessories for SPEEDIER Installation
★ Complete Interchangeability
★ No Sharp Edges to Damage Cables





Globe's two types of cable trays, one a ladder type and the other a basket type, to support cables, wiring and tubing have become increasingly popular because they can be used INTERCHANGEABLY at any given location depending on the type and weight of the cables to be suspended. The advantages of each type tray can be used to the fullest. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is used for the support of communication wire, instrument tubing and control cables in automation applications.

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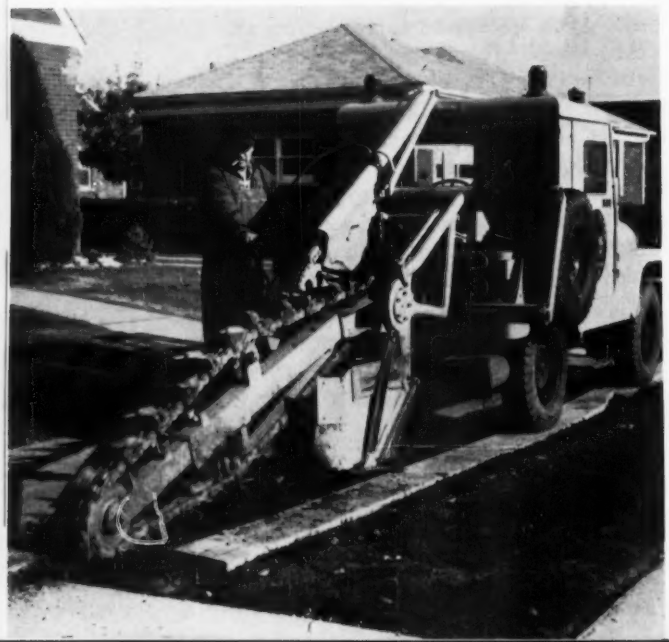
CIRCLE 107 ON READER SERVICE CARD 107

CONSTRUCTION

Jeep Trencher Handles Parkway Cable Jobs



*L. P. **BELLETINI**, Associate Engineer, Underground Lines Dept*
Detroit Edison Co, Detroit, Michigan

Mobility of a jeep-mounted, ladder-type trencher has greatly increased the efficiency of Detroit Edison Co's trenching operations. The trencher is used primarily to dig trenches for underground street lighting parkway cable. The unit moves from one job to another under its own power, thus expediting the scheduling of the equipment.

The trencher consists of a standard jeep vehicle modified to support the digging equipment at the rear and a bulldozer blade at the front. The jeep furnishes the power for digging.

The digging boom and cutter chain can dig an 8-in. wide trench to a maximum depth of 42 in. The digging action is over the digging boom coming up against a shoe which rides on the ground.

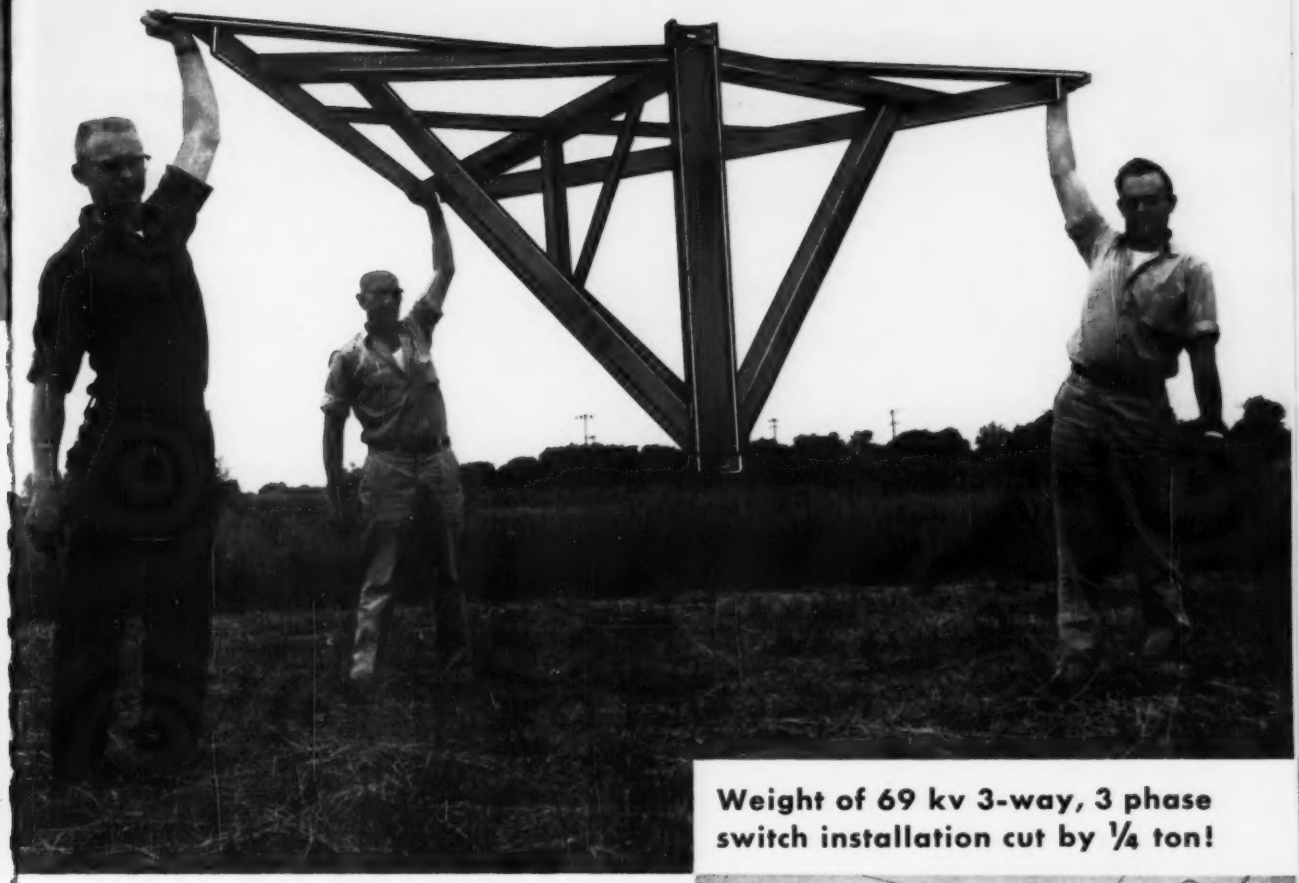
The two-piece digging boom is spring-loaded, which prevents stretches or breaks in the chain should a rock lodge between the chain and the sprocket. This feature eliminates frequent breakdowns, thus resulting in greater usage of the trencher.

Excavated material is drawn by the cutters and holders onto a hydraulically-operated conveyor which can dump on either side of the trench at the will of the operator. Thus, the spoil can be deposited on sidewalks, minimizing damage to lawns. Because the boom can be offset, the trench can be widened if necessary without repositioning the unit.

Backfilling and grading are handled with the hydraulically-operated dozer blade. The blade can be positioned in down or "float" positions and may be angled to the right or left. The blade mounts on the jeep at a point forward of the rear springs to give the trencher better balance.

To meet an increased work load in the street light construction program, Detroit Edison has purchased a second jeep-mounted trenching unit. This machine will take 8-in. and 14-in. wide chains.

(More Construction on page 110)



Weight of 69 kv 3-way, 3 phase switch installation cut by ¼ ton!

ALUMINUM FRAMES

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easier to install — lighter on poles

Now, Chance GOABS give you the added advantages of welded structural aluminum frames as standard equipment. The frames have been designed and field-tested to hold the same loads as steel frames—with greater platform stability to assure good switch operation—and with excellent corrosion resistance for longer life.

Frame weights have been reduced from 40% to 66%. The popular 69 kv 3-way frame shown above weighs only 164 pounds (52% less than its steel counterpart). Less weight makes GOABS much easier to transport, to handle and to mount . . . puts less strain on the pole.

You're dollars ahead from the start when you use Chance Group Operated Air Break Switches for tap switching. Vertical phase-above-phase mounting, requiring only a single pole for 1, 2 or 3 way switching, means lower initial costs, lower maintenance costs, and minimum right of way requirements.

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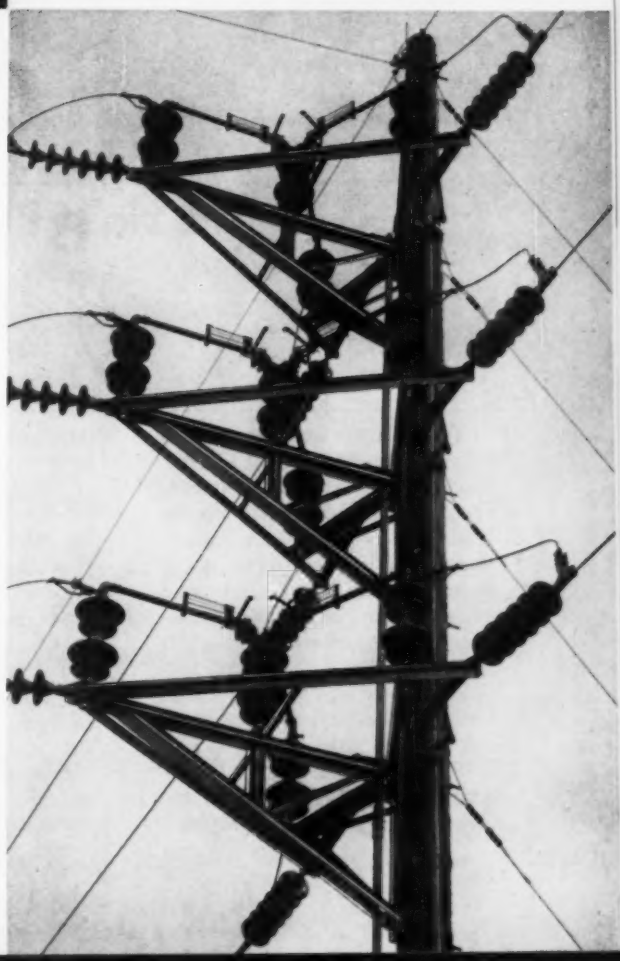
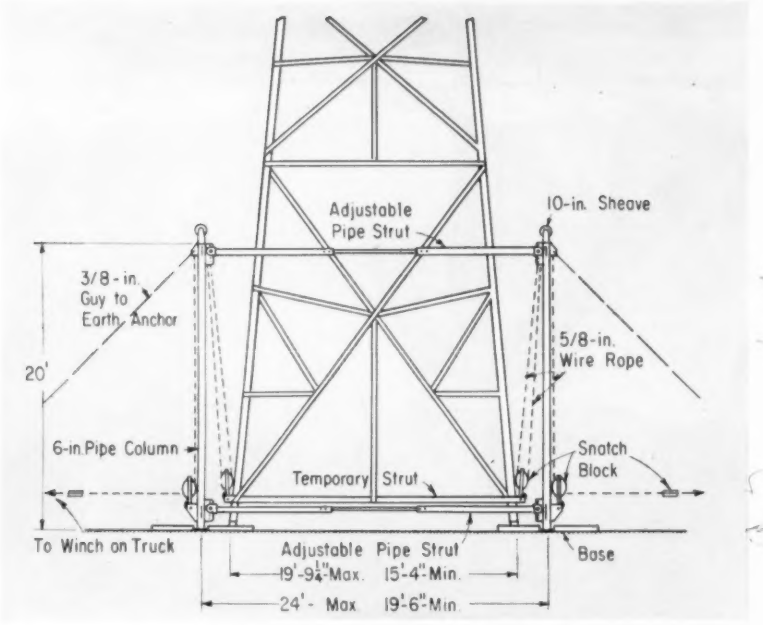
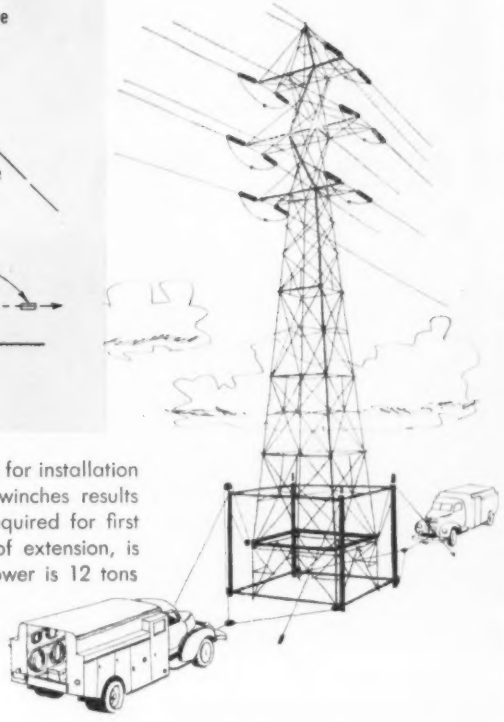


A. B. CHANCE CO CENTRALIA MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto CS59-20

CIRCLE 109 ON READER SERVICE CARD





HOISTING FRAME lifts tower at each corner for installation of base extension. Coordination of truck winches results in a smooth, straight lift. Average time required for first eight towers raised, including installation of extension, is 250 man-hr per tower. Total weight per tower is 12 tons

Hoist Raises Tower Carrying Hot Lines

A. G. MASTERS, *General Supervising Engineer,*

E. J. GESING, *Senior Engineer, Cleveland Electric Illuminating Co, Cleveland, Ohio*

Temporary hoisting frame helps crews of Cleveland Electric Illuminating Co raise towers carrying energized lines for the installation of tower-base extensions. The frame can lift a tower up to 30 ft. Average time per tower lift, including installation of the extension, is 250 man-hr. CEI Co expects this time will be reduced as crews become more experienced with use of the hoisting frame.

The frame of 6-in. pipe is secured by ⅜-in. guys to earth anchors. Lifting tension is provided by ⅝-in. steel cables which run to a winch truck on either side of the tower. Winches hold the towers while steel extensions are installed.

With this equipment CEI has lifted eight towers: an 87-ft line tower raised 10 ft; five 103-ft anchor towers raised 10 ft; a 103-ft anchor tower raised 20 ft; and a 111-ft anchor tower raised 20 ft. Towers are 5½ ft square at the top, and vary at the base from 15½ to 20 ft. Maximum weight, including tower, conductors and extension steel, is about 12 tons. Average time required to raise each tower and install extensions was 250 man hr.

Reconductoring 132-kv lines from 4/0 copper to 795 MCM ACSR increased conductor sags and reduced ground clearances, prompting the tower raising. When the program is completed, CEI Co will have reconductored and raised towers along 93 miles of double-circuit line. Both the 33-yr old towers and new extensions were designed and fabricated by Blaw-Knox Co.

(More Construction on page 112)

How to Slash line work costs up to 50% and increase safety, too

Now, there is a proven method for cutting line work costs up to 50%. It is the replacement of line trucks with SKYWORKER aerial lifts.

These are the facts . . .

Leading utilities have found that their man-hour yield with SKYWORKER is twice as effective as with conventional line trucks.

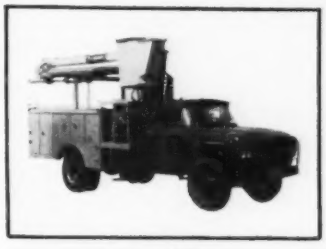
Every time a line truck is replaced with a SKYWORKER, men are utilized more efficiently; important savings in wages and fringe benefits result. Men are released for other jobs . . . for example, growth construction.

Safety records climb, too. Linemen work without fatigue — moving from one work position to another with a touch of the controls. Both the SKYWORKER's work platform and outer boom have high dielectric strength — one of many safety features.

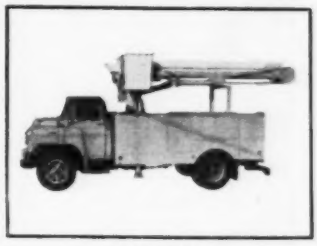
Today's SKYWORKER prices are lower than ever. Or you can lease a SKYWORKER for as little as $2.38 an hour. Lease-purchase plans are also available.

Let us show you the savings SKYWORKER will make possible for you. For prompt information, write or phone Emhart Manufacturing Company, Skyworker Division, Hartford 1, Conn. Phone: Hartford, CHapel 9-0671.

Photo courtesy of "U. I. News," publication of the United Illuminating Company, New Haven • Connecticut • Bridgeport



Model 1035B
Specifically designed for the most rigorous requirements of electrical distribution line work.



Model 4033
Two work platform unit that easily handles the heaviest demands of jobs requiring two men aloft.

NEW SKYWORKER FILM AVAILABLE! WRITE . . .

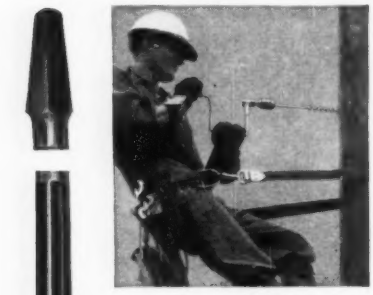
EMHART MANUFACTURING COMPANY

SKYWORKER DIVISION

HARTFORD 1, CONNECTICUT

CIRCLE 111 ON READER SERVICE CARD 111

ONE BIT FITS BOTH



1. Hand Brace

2. Electric Drill

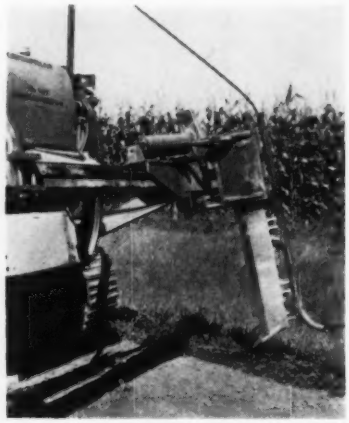
New Irwin Adapter Shank Wood Bit

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16" to 17/16", both solid center and single twist types.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

IRWIN auger bits • screw drivers
Wilmington, Ohio



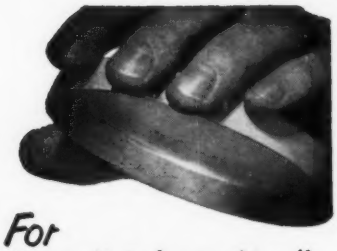
Plow Lays Cable Ten Miles per Day Down to 40 In.

A hydraulically-operated cable plow was responsible for the successful laying of 2½-in. telephone cable along a 139-mile route within 45 days. Mounted on a Caterpillar 977 Traxcavater, the plow is capable of laying 10 miles of cable down to 40 in. in one day. Design of the cable plow suggests that it can be used equally well by electric utilities in cable-laying operations.

The plow was designed and built by Altorfer Machinery Co, Davenport, Ia., for Hawkeye Construction Co. It offers ease in pulling, precise control for positioning the cable in the ground, and convenience in carrying.

The steel tooth of the plow is designed to open a slot in the ground just wide enough for the cable. A replaceable wear shin is added to the front of the tooth, which is strong enough to stall the tractor when an obstruction is met. For ease in steering the tractor, the hydraulic ram angles the tooth with respect to the tractor during turning. The tractor can be turned without touching a steering clutch. While laying cable 14-in. deep, the unit made a 90-turn across an asphalt-paved intersection. The only disturbance to the road was a narrow slit.

(*Continued on page* 114)



For "small-job sealing"...

Johns-Manville

Duxseal

in the new handy pocket roll

THE NEW HANDY pocket roll makes Duxseal® ideal for small sealing jobs in both installation and maintenance work. It thereby increases the usefulness of your favorite all-purpose sealing and caulking compound.

The NEW pocket roll container allows quick removal and replacement of the compound. Its ribbon form makes Duxseal easy to apply in any amount, large or small.

3 types of Duxseal are now available in pocket rolls:

- **STANDARD DUXSEAL** is a permanently plastic gray-green compound utilizing a non-drying, vegetable-oil vehicle. It will not corrode metals, plastics, wood, rubber, or painted surfaces. It adheres well to all common materials. It is non-staining.
- **TYPE N DUXSEAL** has the same properties plus higher resistance to bleeding or dripping at high temperatures.
- **R-100 DUXSEAL** employs a resinous material as its vehicle and has the same properties. It skins fast to provide an excellent paint surface.

A wide range of other J-M Sealing Compounds is also available in pocket rolls. These are described in sheet EL-85A. Duxseal is covered in sheet EL-68A. Write Johns-Manville, Box **14,** New York 16, N. Y.

Johns-Manville

DUXSEAL

Simplify interlocked armored cable installations

WITH NEW T&B FITTINGS

Each size of the new T&B Interlocked Armored Cable Fittings accommodates twice the previous range of cable sizes. They eliminate the problem of armored cable OD that is too large or too small for the fitting. The extra armor stop in T&B Interlocked Cable Fittings and the independently-bolted twin saddles make it possible to accommodate a wide range in armor diameters. The saddles are serrated for positive grip.

For dry or wet locations – T&B Armored Cable Fittings are available for both terminating in boxes or dead-ending, in both dry and damp locations. (Damp location fittings have a neoprene bushing, retainer ring and gland nut to keep out moisture.)

Other advantages: **1)** Fewer connectors are required to accommodate the full range cable sizes. Fewer items in stock. **2)** There is only one connector for each hub thread size. **3)** The basic connector and its accessories are engineered to achieve LOWEST INSTALLED COST.

All T&B products available only through authorized T&B distributors

THE THOMAS & BETTS CO.

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

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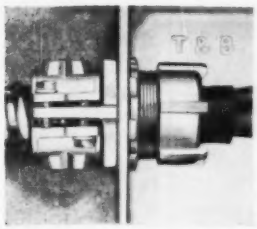
Thomas & Betts, Ltd.,
Montreal, P.Q., Canada

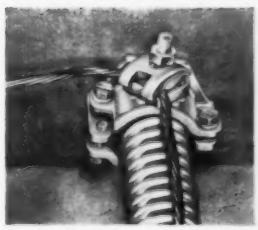
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

THE BASIC FITTING . . .

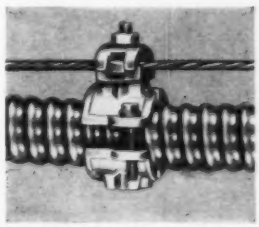
and T&B accessories readily solve specific installation problems . . .



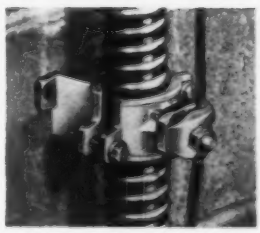
FOR WET LOCATIONS



FOR GROUNDING



FOR HORIZONTAL SUPPORTING



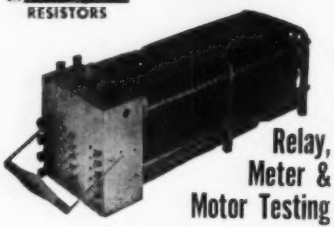
FOR VERTICAL SUPPORTING

For complete details, contact your local T&B distributor or write for Catalog 1A2.

CIRCLE 113 ON READER SERVICE CARD 113

Leaders in Electrical Testing Equipment

Ohm-spun RESISTORS



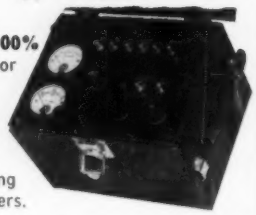
Relay, Meter & Motor Testing

- Non-inductive Resistance
- Smooth adjustment from .05 amperes to full capacity of the load.
- Loads are made in different capacities; 30 amperes, 25/50 amperes and 60 amperes.
- Light in weight yet ruggedly constructed.
- All units self-ventilated.

STATES

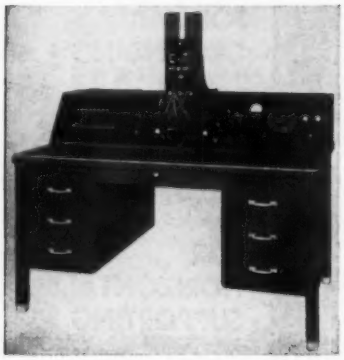
Type ID Load

Provides **50% and 100%** Power Factor from **Single Phase Supply** when testing power meters.



Capacities available: 5-15 and 50 amperes

A 150 Amp. Multi-Purpose Form FA Test Table



. . . for testing Watthour Meters, Graphic Instruments, Indicating Instrument, Relays, Small Transformers.
Handy and versatile here's a table that will provide 0-150 ampere loading with 0-600 volts potential. Phase Displacement is 0 to unity, or 0 to 360 degrees. May be equipped with Photo Electric Counter.

THE STATES COMPANY
19 NEW PARK AVE., HARTFORD, CONN.

Cable Plow

(*Continued from page* 112)

Cable is laid through a two-part boot on the back of the tooth. To pull the tooth from the ground without cutting the cable, one side of the boot is pulled and removed. A pin is pulled and the other part of the boot is removed.

Rides on Draft Frame

The plow may be shifted across the back of the tractor to permit accurate positioning of the cable. The plow rides on a hydraulically-controlled draft frame mounted on the roller frame and extending across the rear of the machine. A hydraulic ram slides the plow across the draft frame. Lifting rams, one on each side, are indepedently controlled to permit leveling of the draft frame when working on a slope.

The hydraulic ram cylinder is pinned to the draft arm; the piston to the plow-mounting bracket. In this position it can move the tooth from the opposite side to about 2 in. across centerline. To use the tooth on the other side, the operator pulls one pin, turns the cylinder over to the other side, and replaces the pin. The plow-turning cylinder slides along the frame with the plow and is held to the mounting bracket by three pins. Hard alloy wear plates on the draft frame and inside the slide are replaceable.

Quick-Couple Holds Reel

Cable carried on the front of the tractor is fed over the top through two fairleads. Two sheaves mounted on the rear fairlead accommodate laying from either side. The cable reel is mounted on a bar on the front, held by a "quick-couple" to braces from the bucket. The tractor's tilt and hoist frame permits one man to change reels, working on the ground or a truck. Four extra hydraulic valves have been added above the tractor's tank to handle the additional hydraulic tasks.

On one job, the plow mounted on a 955 Traxcavator laid a mile

(*Continued on page* 116)

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1 **Send in the coupon below.**

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It'll put you on top of the "Routing Slip," on top of industry developments and who knows, maybe someday on top of the heap. The cost: $6 for 52 issues. No need to send money now.

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Many industrial wood users share this viewpoint. It's one of the major reasons they give for consistently specifying AMCRECO pressure-treated products.

Take the preservation method. Service records – some going back over 50 years – show that AMCRECO pressure treatment provides the longest, most dependable wood protection. Added to this is a big plant modernization and expansion program which totals nearly one million dollars... new, improved facilities that help insure fast service to all AMCRECO customers.

Why not consider this unusual combination of experience and equipment before you place that next order?

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The Pressurized
Portable and Wheeled
DRY CHEMICAL
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TAMPER-PROOF Unreported use or improper recharge signaled instantly . . . BEFORE the emergency of a fire.

NO MAINTENANCE EXPENSE Service necessary only after actual use; routine parts disassembly and inspection eliminated.

LONGER RANGE High pressure discharge reaches farther for hard-to-get fires, allows operator to attack fire without fear of being burned

WEATHER-PROOF FROM 120° TO −65°F. 350 psi nitrogen gas pressure assures maximum operating efficiency even under extreme weather conditions.

Safety First PRODUCTS CORP.
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Safety First Prod. Corp., Elmsford, N. Y.
Please send data on Safe-T-meter extinguisher
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COMPANY .....
STREET .....
CITY ..... STATE .....

Cable Plow

(*Continued from page* 114)

of telephone cable 14-in. deep in 65 min over terrain too tough for the telephone company's two rubber-tired tractors. On another job it laid cable 33-in. deep at 2 mph in rough terrain. The Rural Electrification Administration has approved its use for telephone cable laying by REA-financed companies.

CIRCLE 51 ON READER SERVICE CARD

Neoprene-Nylon Seals Wall Openings

Neoprene-coated nylon fabric has been used to weatherproof wall openings at McMeekin Station of South Carolina Electric & Gas Co. The fabric provides a closure around steam and water pipes.

The flexible fabric was selected for its resistance to high temperatures and humidity, deterioriation, and tearing stresses. Temperatures where the fabric contacts the insulated pipes are in the 50-150F range.

Twelve fitted wall-opening covers, in sizes 6x9 ft and 7x9 ft, are held around the pipes with clamping bands and secured to the walls with clamping flanges and strips. Total cost for the installation was about $650. The fabric is neoprene-coated Coverlight-N, made by Reeves Brothers, Inc.

CIRCLE 52 ON READER SERVICE CARD

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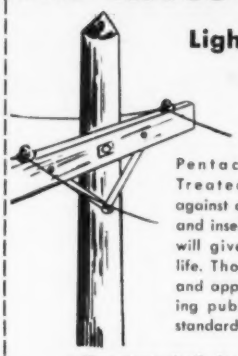
CIRCLE 147 ON READER SERVICE CARD

Haley's

CEDAR POLES and FIR CROSS ARMS



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Pentachlorophenal Treated—protected against decay, moisture and insect damage, and will give long service life. Thoroughly tested and approved by leading public utilities as standard construction.

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SPITZER BLDG.
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more oomph

Like some people, some derricks have a little extra oomph. This derrick—Holan's Series 6800 has it . . . especially in the lower operating ranges.

The 6800 has extra strength because of extra lift cylinders—four instead of two. It lifts 2,000 pounds when only 5½ feet from the ground . . . body-loads 4,000 pounds. Capacity is 8,000 pounds.

More digger oomph, too

The digger here is Holan's 3-speed Series 5400. Maximum torque is 8,400 foot-pounds—tops by far among derrick-suspended diggers. With the power of the derrick and digger combined, you could bore through just about anything.

If you are in the market for power equipment with that extra oomph, get in touch with a Holan Field Representative.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

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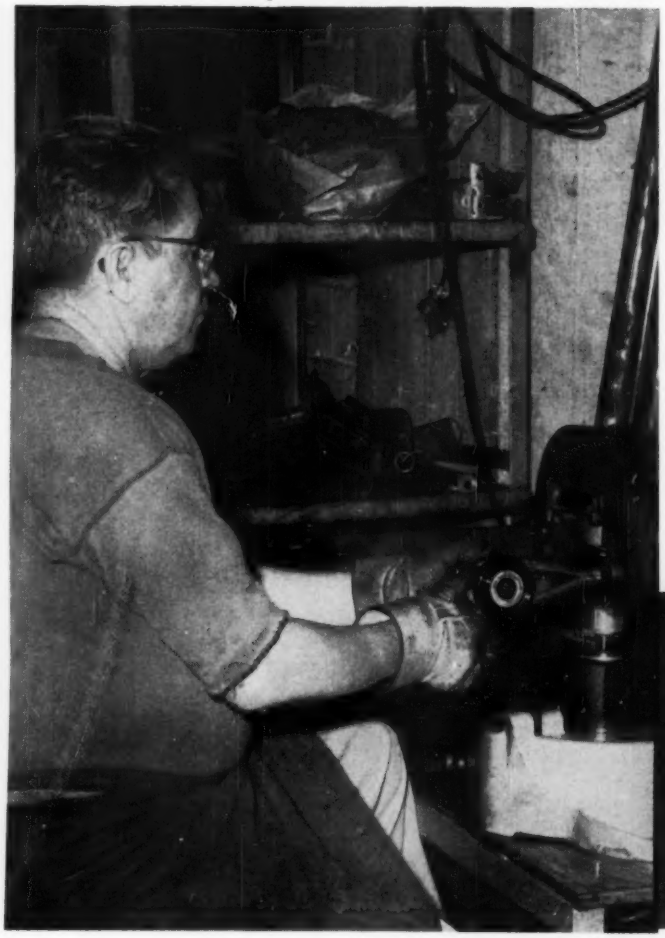
HOLAN

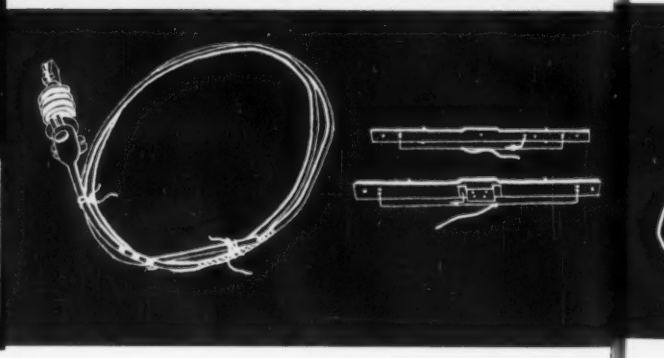


Shop-made Units

B. F. GLUNT, *Foreman, Materials Division, Cincinnati Gas & Electric Co, Cincinnati, Ohio*

Shop-assembly of many standard components of overhead lines provides accurate control over quality and lowers the installed cost for Cincinnati Gas & Electric Co. This method also allows the company to schedule production to hold inventories within desired limits. This article describes some of the more typical preformed components made in CG&E's shops.

Preformed 15-kv and 5-kv potheads are made in the shop under near ideal conditions. They are completely assembled on short lengths of cable to eliminate exposure of cable ends during installation. They simplify installation and minimize pole work.



Condensate Control System Allows Operation

JOHN BAIL, *Control and Instrument Engineer, Power Production Dept, West Penn Power Co, Greensburg, Pa.*

A low-cost condensate control system applied to old low-pressure equipment permits satisfactory operation down to 10% of rated capacity and without increasing the maintenance on condensate pumps. Cost of this recirculation scheme will be returned through savings in system generating costs provided by low-load operation of the units. In addition, operating cost is minimized by retaining submergence control of the condensate pump and no unnecessary recirculation.

The condensate control scheme has been applied to several low-pressure units at West Penn Power Co's Springdale Power Station. These had been operated without difficulty down to 50% of rating with nothing more than suction submergence regulating the condensate pump output. When system operating economy dictated operation of the units at lower loads for a great number of hours, ejector performance decreased due to insufficient cooling water flow to the ejector condenser. At these lower loads, it appeared that cavitation of the pump would increase maintenance.

Low-load operation called for a condensate control system which would provide recirculation to cool the ejectors at the low loads still using, for economy,

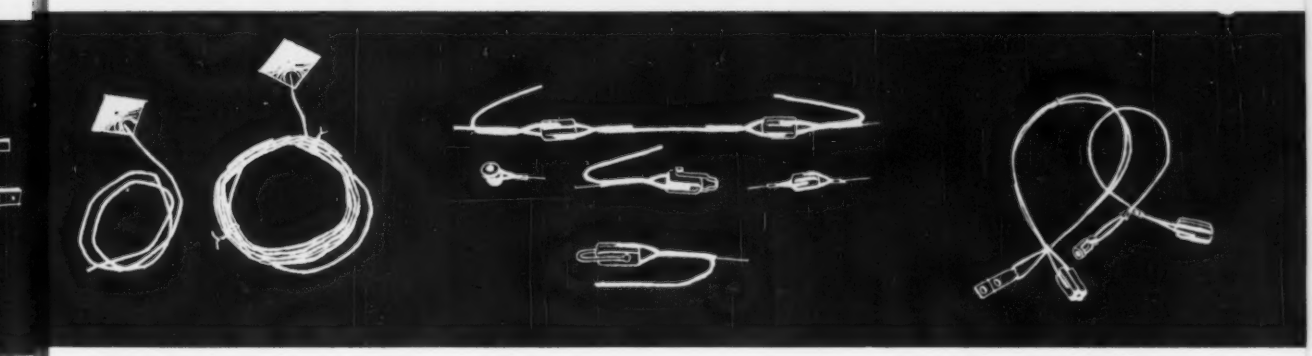
Lower Installed Cost

Another time-saver in the field are assembled pothead arms in 13-kv and 4-kv sizes, made and stocked as a unit. The arms are assembled with mounting bolts for potheads attached and properly spaced. The 13-kv unit includes a mounting bracket; no bracket is used on the 4-kv arm because the pothead is installed offset from the pole center line. Pothead grounds are attached with compression joints.

Also assembled and stocked as a unit are pole grounds. They are made from salvaged and short pieces of new wire into 45-ft lengths of No. 6 WP copper for distribution use and 8-ft lengths of No. 2 SDB copper for transmission lines. Plates are 6-in. square copper purchased cut to size from "mill ends" or "mill scraps" of various gages. Plates are punched in the center for a nail. Total usage of preformed grounds by Cincinnati G&E was 7,450 in 1958.

Various sizes and types of deadends are shop-made for use with mechanical push-on line splices. Deadends are assembled from salvaged spools, breakers, clevises, and wire almost entirely. Some splices are of the compression type, while others are served by machine, soldered and taped. As proper compression sleeves become available, served joints will be eliminated. Total usage of all types of preformed deadends was 10,870 in 1958.

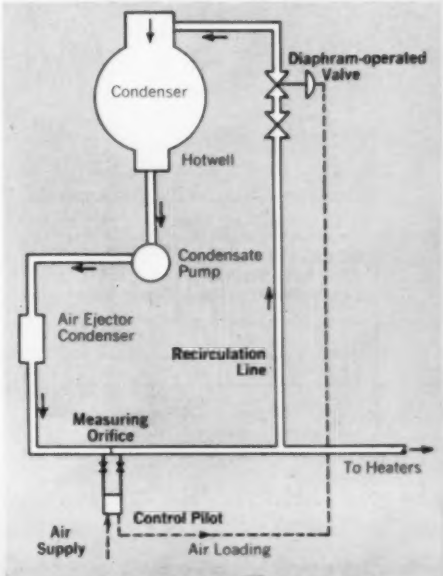
Single and double down and head guys also are preformed. These standardized units are specified on field construction drawings from the pole fitting to the first breaker. Pole fittings are of several types—single and double bolt, angle, head and thimble eyelet. Compression joints and guy wire, usually salvaged from short lengths returned from the field, are used. During 1958 use was made of 3,102 preformed guys by the company.



of Older Units Down to 10%

submergence control on the pumps. This was accomplished by installing an orifice in the piping following the air ejectors. Across this orifice is connected a Leslie UA-2 differential pressure control pilot. Output from the pilot runs to a diaphragm-operated valve in a recirculating line back to the condenser. The recirculating line was connected to the system after the air ejector so that an increase in the flow back to the condenser will raise the flow through the air ejectors and through the measuring orifice.

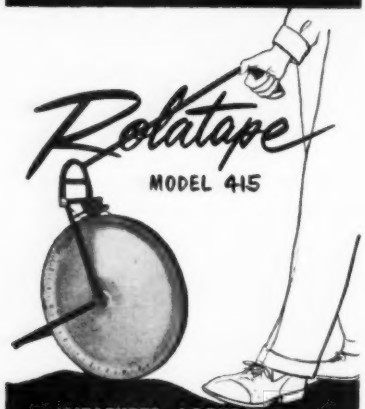
The control is adjusted so that there is no recirculation above the minimum flow required for good ejector operation. When demand for condensate falls below this minimum, the control opens the recirculating valve, providing adequate water flow for air ejector and condensate pump operation. Cost was minimized by using the blind controller and one valve for recirculation.



It's New!

NOW–AT LAST A MEASURING WHEEL THAT MEASURES ACCURATELY TO A FRACTION OF AN INCH!

Rolatape's amazing new Model 415 meets all your measuring needs — measuring quickly and surely over the most uneven and irregular terrain with no risk of human error. This time-saving instrument is calibrated to measure accurately in full view of operator as it is rolled along, giving measurements in inches (to ½ inch) on one side of measuring wheel, and tenths of a foot (to .5 of a foot) on the other. Sturdy and lightwight, it is equipped with automatic brake and built-in stand. Handle folds compactly. See one at your dealer's today.



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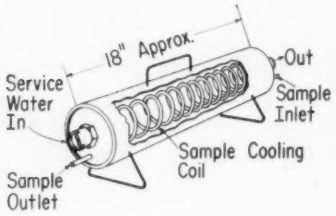
Cooling Coil Tests Condensate

A. G. LLOYD, Staff Engineer, Mechanical Engineering Division, American Electric Power Service Corp, New York, N. Y.

A portable cooling coil can help provide a comprehensive survey of cycle water conditions by permitting condensate sampling at any desired location. It is an invaluable aid in locating sources of contamination during initial clean-up of the cycle. It can be made from stock material.

The shell is made from an 18-in. length of 4-in., schedule 40 pipe. The coil of about 12 turns is formed by winding a length of ¼-in. diameter soft copper tubing around a length of 2-in. pipe used as a mandrel. End closures containing holes for the tubing and "quick snap" connections for service water are cut from ¼-in. steel plate.

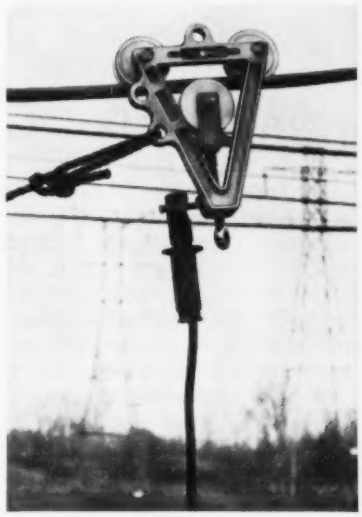


The coil is formed first and the ends passed through the end closure plates. The coil ends are secured to these plates before final welding of the plate to the shell. A ¾-in. "quick snap" connection is screwed into a tapped hole in each end for service water. Ends of the copper tubing may be left plain or may be fitted with tubing connectors. For ease in handling, the shell may be fitted with legs and a handle.

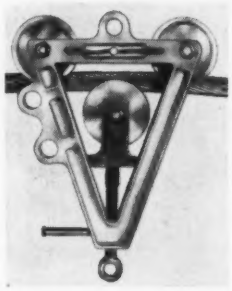
Service water acts as the cooling medium. The coil may be connected readily with copper or rubber tubing to a drain, vent or pressure tap connection at the desired sampling location. Adequate flushing of sample points should precede procurement of the sample. Throttling the sample at the header valve saves putting additional valves on the coil.

(More Operation & Test on page 122)

for Safe WIRE STRINGING



Bashlin's precision built TRAVELING GROUND



No. 795 Close-up view of the new Bashlin Traveling Ground for Safe Wire Stringing.

Here are features of the Traveling Ground you will recognize as essential for Safe Wire Stringing. 1. Positive ground. 2. Light weight. 3. Eye for hotstick pickup. 4. Bronze oiled bushings. 5. Brush pickup with shunts to common ground. 6. Brass shoulder bolt axle. 7. Adjusts for conductors to and including 795,000 cm. ACSR. 8. All parts replaceable. 9. Shouldered pin to attach ground clamp. 10. Operates in either vertical or horizontal position. 11. Can be installed without threading through. 12. A Heli-Coil thread is used in the frame.

Distributors in Strategic Areas in U.S.A.

EXPORT: Copperweld Steel International Co. IN CANADA: A. B. Chance Co. of Canada Ltd., Toronto

Write for your copy of supplement to Catalog No. 356 giving complete details.

W. M. BASHLIN CO.
GROVE CITY, PA.

use these 8 reliable helps to pole hardware selection...

SEC PH 2

TRANSMISSION HARDWARE

Greater flexibility and economy in the design of both complex and simple wood pole structures for transmission and distribution lines. Transfers larger loads — reduces bolt slotting.

SEC PH 3

AERIAL CABLE HARDWARE

Cable suspension clamps offer a most dependable, economical and easy method of attaching cable to poles. Large area pads with integral teeth increase both vertical and longitudinal stability.

SEC PH 4

GUY AND DEAD END ATTACHMENTS

The new, improved MIF Guy Hook is the most economical and efficient attachment for thru bolt guying. Permits easy attachment of any type guy dead ending device.

SEC PH 5

TRANSFORMER MOUNTING PLATES

Better, stronger direct pole mounting of distribution transformers at less cost — quick, easy, inexpensive installation requiring no special tools; can be attached to transformer prior to field installation.

. . . they are the eight product group sections of the new MIF Pole Line Hardware Catalog — each section a complete catalog in itself.

SEC PH 6

GUY CLAMPS

Greater holding power per dollar. "Come-along" action type clamp can be installed in seconds without disassembling it. Accommodates a wide range of strand sizes.

SEC PH 7

GAINS — CROSSARM AND GRID

Crossarm Gains eliminate expensive cut gains on pole, increase stability, reduce possibility of rot and pole fires. Grid Gains strengthen single bolt connections, distribute loads over large wood areas.

SEC PH 8

WASHERS

MIF Washers give greater strength on a comparative weight basis, and added resistance to corrosion. All are of reinforced, boss and rib design to put metal where strength requirements dictate.

MIF

POLE HARDWARE DIVISION

Malleable Iron Fittings Company

BRANFORD • CONNECTICUT

Research, Engineering, Manufacturing for over 100 years

SEC PH 9

MISCELLANEOUS POLE HARDWARE

Pole Top Bracket for use with post type insulators. Timber Connectors to reduce slotting. Guy Strand Holders for safe handling of strands. Pole Mounts in 5 sizes.

CIRCLE 121 ON READER SERVICE CARD

Cleaning Problem?

SONOCEN®

Ultrasonic Cleaners by

BRANSON

may be your answer!

½-gallon and larger benchtop models, and (illustrated) 5- and 12-gallon self-contained rollaround units.
Bulletin S-509, S-217B

Built-in cabinet-type wash-and-rinse cleaning systems.
Bulletin S-233A

Modular cabinet-type systems with Cleaning, Filter / Heater / Recirculator, Rinsing, and Drying units.
Bulletin S-236

Custom-engineered cleaning installations: for batch and conveyorized cleaning, and for continuous-flow cleaning in strip and wire mills.
Bulletin S-235

Branson offers experienced counsel in adapting the flexibility of SONOGEN® Ultrasonic Cleaning Equipment to your needs. Tell us the problem, and we'll follow through from planning and installation to maintenance, with factory-trained specialists available nationwide.

Send Coupon to BRANSON ULTRASONIC CORPORATION
19 Brown House Road, Stamford, Connecticut

BRANSON: Send SONOGEN® Bulletin

NAME_____

FIRM_____ DEPT. _____

ADDRESS_____

Reverse Mounting Offers Operating Benefits

MOUNTING BRACKETS on the secondary side is the idea of Harold J. Halligan of Kansas P&L Co

Reverse-mounting of a distribution transformer offers a number of operating and cost-saving advantages to Kansas Power & Light Co. Compared with the conventional transformer having mounting brackets on the primary side, by putting the brackets on the secondary side:

1. The secondary is next to the pole, making it easier for a lineman to work on the secondary.

2. The energized primary bushing is moved away from the pole and from the area where the lineman is working.

3. Appearance of the installation is much impoved.

4. Material cost is only a fraction of that for conventional mounting. Reverse mounting eliminates secondary racks, rack extension brackets and long secondary leads through use of pole hooks and short leads. Material cost for a conventional mounting is estimated at $15, whereas reverse mounting costs amount to about $1.50.

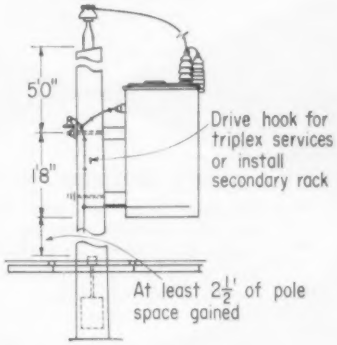
Reverse mounting is being given a trial in the Topeka Division. Ten of the new transformers are serving a trailer court; 16 more will be installed in a second trailer court.

The new design, developed by KPL's Harold J. Halligan, removes the extra height requirement on new poles and will save the replacing of many poles when additional space for transformer installations is required. The normal joint-use pole is 35-ft high; for transformer installations, it has been necessary to install 40-ft poles. The added height provides the required clearance between secondaries and services and telephone equipment. With the reverse-mounted transformer, secondaries and services can be kept at a higher point on the pole, allowing the use of 35-ft joint-use poles for transformer installations.

Improvements Made

The original reverse-mounted unit has been improved with a new arrangement of secondary leads on the transformer. Leads are crossed on the transformer to put both hot leads on each side of the transformer. Service lines going off in either direction now do not have to cross the transformer.

Attachment of the crossed leads in the shop eliminates field installation and reduces the overall cost of the job. Halligan is in the process of making further improvements on the secondary lead arrangement.



REVERSE MOUNTING allows the use of a 35-ft pole for joint-use transformer installations

Several major transformer companies are interested in the transformers. Field trials of the new units will be watched closely to determine possible improvements.

CIRCLE 53 ON READER SERVICE CARD

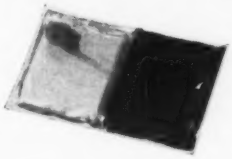
Inside story of

REG. U.S. PAT. OFF.

SCOTCHCAST BRAND Resin Splices

"SCOTCHCAST" BRAND Resin No. 4 is an epoxy resin developed especially for field splicing. Weathering, moisture, pressure, or general aging encountered in normal burial or overhead service does not affect it—field splices can now have the same modern, complete protection and insulation as shopcast motor coils, transformers, and condensers. Convenient kits assure positive electrical insulation, corrosion protection, moisture resistance, and trouble-free maintenance splice after splice!

"SCOTCHCAST" SPLICING KITS



Kits feature "SCOTCHCAST" Resin No. 4 in single-use "Unipak" Container. Two-Part plastic bag contains resin and hardener. To use, bag divider seal is broken; laboratory correct mixture results. Resin is poured right from bag into mold; sets in minutes. Kits are for use on all non-shielded cable splices.

82-A Series Kits for straight or inline splices with cable O.D.'s from ¼" to 1¾". Contains everything needed to insulate one splice: "SCOTCHCAST" Resin No. 4 in "Unipak"; mold halves; pouring spouts; sealing tape. Cutaway photo shows complete blocking of moisture-entry points.

82-B Series Kits for excellent electrical and physical protection of wye splices with cable O.D.'s from ¼" to ⅝". Cut-away shows moisture proof penetration of "SCOTCHCAST" Resin No. 4 into all voids of splice mass.

90-B1 Kit for positive protection of wye or tap splice, insulation over split-bolt connectors or control cable taps. For surface or underground uses. Like all "SCOTCHCAST" Kits, assembles quickly and easily; gives electrically tight splice protection without need of special skills.

"SCOTCHCAST" RESIN PRESSURE SPLICE

With the "SCOTCHCAST" Resin Pressure Method, cable splices and terminations, regardless of size or configuration, can be insulated easily . . . difficult jobs such as shielded cable splices, terminations, and sheath repairs are readily accomplished. Method utilizes "SCOTCHCAST" Resin No. 4 in "Unipak" container injected into a screen-fabricated mold by specially designed pressure gun.

Cut-away inline splice shows complete penetration of resin with pressure-splice method. Will insulate splices on rubber, synthetic or lead insulation or sheath cable . . . shielded and unshielded.

Shielded wye splices are easily handled with "SCOTCHCAST" Pressure Splice Method. Shielding continuation is built into the splice insulation. Total moisture and physical protection is an extra feature of this method.

Outdoor cable termination illustrated is for use at 9 KV. Lower cutaway portion shows stress cone. Entire termination—including stress cone—is resin saturated in one operation. Available in building block components up to 15 KV.

The versatility of the "SCOTCHCAST" Splice Protection System is such that nearly any type of cable connection or termination can now be resin insulated. Our representatives will be glad to advise or assist you in adapting "SCOTCHCAST" Kits and Pressure Methods to your needs. Just write on your letterhead.

FREE BOOKLET describes "SCOTCHCAST" KITS and Pressure-Splice Method. Illustrates applications; details electrical properties. Write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. EAU-99.

"SCOTCHCAST" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO.

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

New System Handles Job Tickets Efficiently

ARTHUR E. BIGLER, *Office Engineer, Southeastern Division, Louisiana Power & Light Co, New Orleans, La.*

CONTROL CARD for work ticket may be found in seconds from file number, work ticket number, or customer's name or address. Movable signals show progress of the job

A new record system at Louisiana Power & Light Co's Southeastern Division engineering office has reduced work ticket filing time, facilitates locating work tickets, and all but eliminates the possibility of misfiling. Jobs handled by this office range from maintenance work to new construction.

Until about two years ago, the office staff used a vertical card file system to control about 1,000 work tickets annually. While this system held all necessary information about the status of individual jobs, it was not only cumbersome to handle but also distinctly inefficient. When a job was created, it was assigned a district number in one of eight districts from a block of numbers for that district.

On a given day, the first work ticket filed might cover a job in Amite District that was the 54th job authorized in that district that year. The second order processed that day might have been from Riverlake District, the 209th of the year from that area. The Amite work ticket would be given number 54, and the Riverlake ticket number 309.

It was impossible to file work tickets numerically under such a system. A loose-leaf cross-index job-record book was necessary in addition to the job card file. Even then, it was necessary to go through the vertical file card-by-card to locate a specific job by customer name or address only. Finding a card for a job in one of our largest districts often took as much as 30 min. Furthermore, while cards showed where the work ticket actually was, they were physically shifted from one classification to another as the ticket progressed through the job.

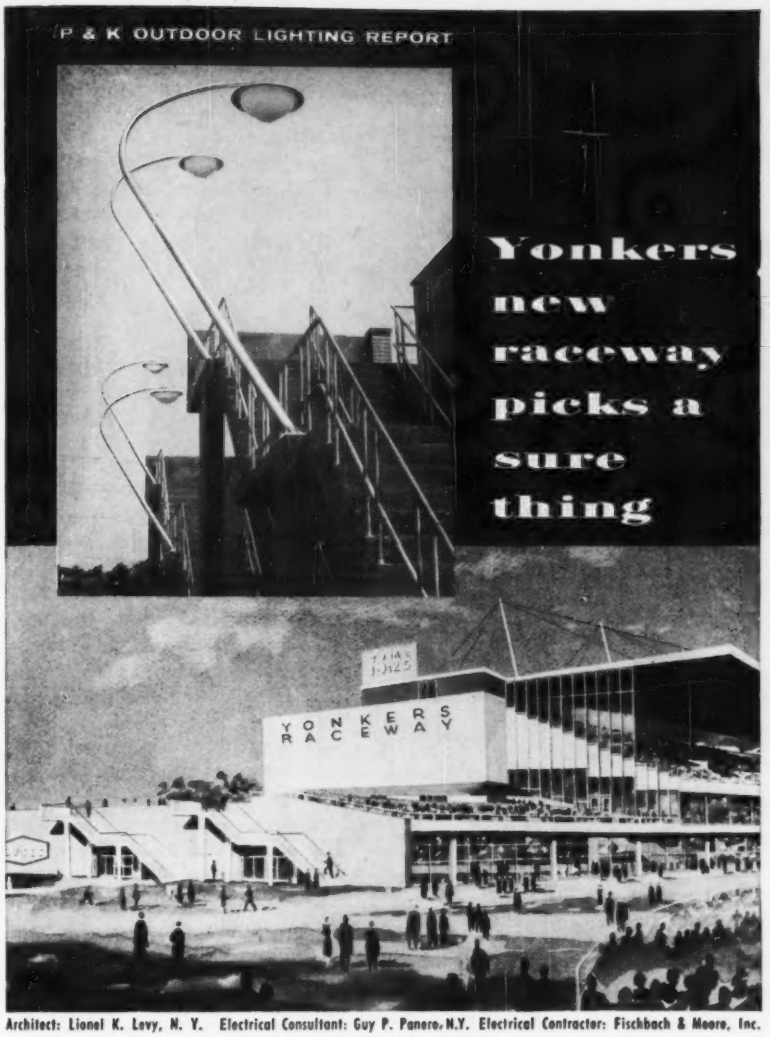
A records consultant studied the problem and prepared a Remington-Rand 6x4 Kardex form to our specifications. This form gives full data on the progress of every job from the time it is initiated until its completion. The Southeastern Division service area includes 11 parishes (counties). Yet with the new filing system the work ticket on any specific job can be found in an average of 10 sec.

District numbers have been eliminated; all work tickets are numbered consecutively as received for numerical filing of the permanent control cards. Each card carries its file number, work ticket or job order number, title of job, location, expenditure requisition, work authorization number and job order. Additionally, each card has spaces to show exactly where the actual work ticket has been and where it is at the time of reference, as well as the date of receipt of work authorization application.

Spaces are provided to show when the work ticket went to any of 11 phases in the job. Corresponding spaces at the bottom of each card permit the use of movable signals which show job progress at a glance.

(*Continued on page* 126)

P & K OUTDOOR LIGHTING REPORT



Architect: Lionel K. Levy, N. Y. Electrical Consultant: Guy P. Panero, N.Y. Electrical Contractor: Fischbach & Moore, Inc.

CIRCLElux DAVITS LIGHT THE WAY

Here, at the country's newest and most luxurious track, P&K all-aluminum CIRCLElux davit-style lighting standards were chosen. Their natural functional beauty add a modern complement to the surroundings. For example, the units illustrated are 10 foot gracefully arched davits with our CIRCLElux fluorescent luminaire. CIRCLElux incandescent luminaires were used in other applications at the raceway.

The wide range of styles available, along with the choice of three lighting sources—incandescent, fluorescent, and mercury vapor—enables you to effectively customize any installation with a "package" unit, standard and luminaire, complete and ready for installation. This means easier specifying and easier installation, and it is good to know that P&K aluminum standards never require painting or other costly maintenance, keep their good looks for years and years.

For more facts send for bulletin LTG-30 describing the complete range of CIRCLElux lighting packages.

P&K

PFAFF & KENDALL 84 FOUNDRY ST., NEWARK 5, N. J.

IN CANADA: POWERLITE DEVICES, LTD., TORONTO, MONTREAL, VANCOUVER
EXPORT REPRESENTATIVE: PHILIPS EXPORT CO., NEW YORK, N. Y.

CIRCLE 150 ON READER SERVICE CARD

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

SAFER

WESTINGHOUSE 1¼%-STEP REGULATORS

Do you always know . . . for sure . . . the position of the tap changers in your regulators? You can, with the Westinghouse position indicator which gears down from a higher speed cable drive. This eliminates drive cable error, prevents danger of bypassing off-neutral position. Dial can easily be read from the ground.

In addition, where load range selection is used, internal indicator detents prevent movement of limit switches from set position to provide positive range limits.

Here is more evidence that Westinghouse feeder voltage regulators are safer to operate, assurance that you can offer better service . . . all the time. J-70901

Westinghouse URF and URL single-phase feeder voltage regulators

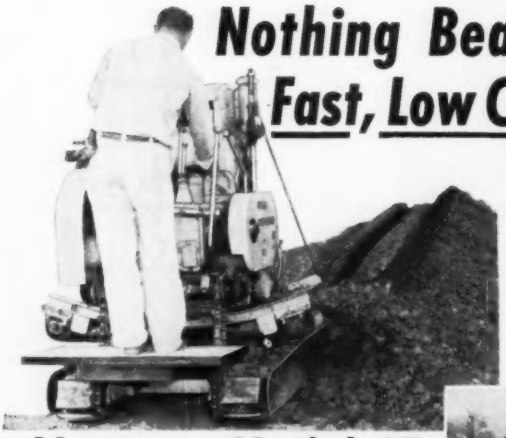
YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

CIRCLE 125 ON READER SERVICE CARD

Nothing Beats It For Fast, Low Cost Digging



Here's a front and rear view of the more powerful, compact 4T Vermeer Pow - R - Ditcher in action. If you are looking for a low cost, rugged, time - saving ditcher, take a look at the 4T before you buy.

Vermeer Model 4T POW-R-DITCHER

This rugged, self - propelled Pow - R - Ditcher is only 48" wide, 6' high and 13' long and can be transported in a pickup truck. A "midget" ditcher that is ideal for laying gas, water and narrow service lines. The 4T is highly maneuverable — digs 6" to 14" wide and down to 4½' deep.

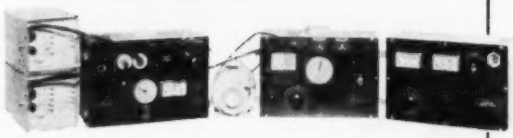
WRITE FOR COMPLETE INFORMATION, LITERATURE AND LOW PRICES ON THE COMPLETE POW-R-DITCHER LINE.

VERMEER MANUFACTURING CO.
1472 W. WASHINGTON ● PELLA, IOWA

CIRCLE 151 ON READER SERVICE CARD

A NELSON FIRST

PORTABLE RELAY TEST UNITS FOR PROPER TESTING & MAINTENANCE OF SWITCHGEAR COMPONENTS



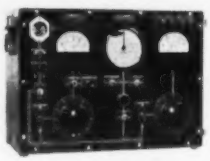
Type RA1-1 Nelson portable test units which may be used in combination for complete testing of switchgear components.

USE NELSON RELAY TEST UNITS TO

- **Improve Operating Performance**
- **Eliminate Excessive "Down-Time" when testing switchgear.**

Up to now a complete rewiring job was necessary to test each different device in a piece of switchgear. Nelson's field service department, working with Nelson's engineering and research departments, has produced a portable relay test unit that will test relays, meters, coils, circuit breakers, etc.

Use Nelson test units to reduce testing time, "down-time" and eliminate much lost production due to present testing methods.



Type RD1-1 Nelson portable test unit for simple testing of meters, protective relays, overload heaters, tripping coils, etc. For use with AC circuits only.

A major source of Electrical Control Equipment for Industry

Write for Bulletin 774

NELSON Electric MANUFACTURING CO.
TULSA, OKLAHOMA

Handles Job Tickets

(*Continued from page* 124)

Thus, it is easy to see how many jobs are in a given department at a given time. Similarly, the signals show where the ticket is on any specific job. The cards, however, give the dates on which work tickets move from one location to another.

The engineering office does necessary drafting and prepares estimates in connection with the preparation of work tickets and work authorization. It also furnishes requisitions for job materials and prepares semi-annual property reports, tax reports and other records. The new record system makes our department staff of ten people about 10% more efficient than it was with the old vertical card file system.

The clerical typist who handles the filing under the present system uses a two-line Chaindex file for cross-indexing each work ticket by location (street address) and customer name. Two supplementary cross indexes are used for quick and easy location of work tickets. Both are numbered consecutively, one by work ticket number and one by Division file number. File folders containing work tickets are filed numerically according to the file number shown at the top of the permanent file card. An outcard shows where any folder has gone if it is removed from the filing cabinet.

CIRCLE 54 ON READER SERVICE CARD

(*More Maintenance on page 128*)

HELICOPTERS FOR EFFICIENCY IN LINE PATROL AND INSPECTION

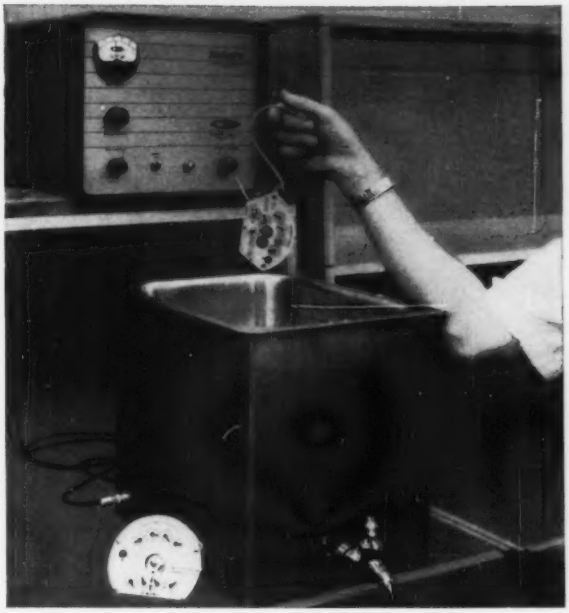
- *DEPENDABLE SERVICE*
- *EXPERIENCED PILOTS*
- *MODERN EQUIPMENT*
- *CONTRACTS ACCEPTED ANYWHERE*

Now Scheduling Autumn and Winter Transmission Line Patrols

INLAND AIR LINES, Inc.
Myrtle Beach, S. C. Phone HI 8-3549
Box 644

CIRCLE 126 ON READER SERVICE CARD

CIRCLE 152 ON READER SERVICE CARD



now! **CUT** *meter and instrument maintenance* **COSTS** *with a...*

Narda *SONBLASTER*®

Ultrasonic Cleaner!

300-Watt G-1501 Generator, 5-gallon NT-1505 Tank
Other models from $175; 2-year guarantee on all units

$695

- Users report almost 90% savings!
- Clean complete assembly at one time!
- Eliminate labor & mechanical brushing!
- No special skills or training needed!

Cleaning meters and other instruments the old-fashioned way is tedious and expensive—can add up to labor costs as high as $9 or $10 per register—unless you use a Narda SonBlaster! Then, it's more like $1 per unit, and this figure comes from an actual user.

Some more examples: One company cleaned 16 units in 36 minutes, including preparation. Another reports that switching to Narda to clean cumulative demand registers as assembled units saves $11,000 annually, per 10,000 units processed.

How's it done? Merely fill the tank with solvent, flip the switch, and submerge your complete assembly. In minutes... seconds...every shaft, gear, bearing and part is meticulously clean!

Narda will be glad to show *you* how to start saving *immediately* on cleaning meters, timing devices, and instruments in general. Write us, outlining your problem. Address: Dept. EW-8.

More SonBlasters sold than all other ultrasonic cleaners combined!

the narda ultrasonics corporation
625 MAIN STREET, WESTBURY, L. I., N. Y. • EDgewood 3-5400
5785 North Lincoln Ave., Chicago, Illinois • LOng Beach 1-4625
3259 Wilshire Boulevard, Los Angeles 5, Calif. • DUnkirk 8-2201
Subsidiary of The Narda Microwave Corporation

CIRCLE 153 ON READER SERVICE CARD

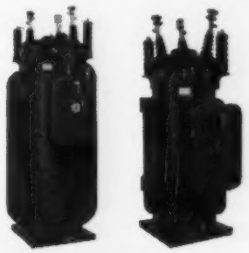
YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

RUGGED

WESTINGHOUSE 1¼%-STEP REGULATORS

Are your regulators rugged enough to meet *all* the conditions they're likely to encounter over a long period of service? Well, here is an exclusive Westinghouse idea that greatly lengthens contact life. Westinghouse regulator contacts are designed to give maximum contact life under all conditions. Higher current ratings make use of a unique magnetic effect to multiply contact pressures under short circuits to prevent burning. Normal contact pressures are maintained under usual operating conditions to prevent galling.

With Westinghouse voltage regulators, you get this and many other exclusive benefits that mean longer, more dependable service. For full details, call your Westinghouse representative. J-70922



Westinghouse URF and URL single-phase feeder voltage regulators

YOU CAN BE SURE...IF IT'S
Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

CIRCLE 127 ON READER SERVICE CARD

SUPERVISORY GROWTH

How a supervisor thinks and acts the way he handles people and problems, is felt far beyond the confines of his own area of operations. It "echoes" throughout your entire organization.

Because he is your personal representative at the work level, expanding the supervisor's capacity to manage is an important objective.

Assisting him to grow and develop assures the kind of performance that reflects itself in higher returns from company payroll dollars.

This is the job **MANAGEMENT INFORMATION** does. Here is a practical program based on mind-stretching material geared to today's needs.

Specifically designed to help the supervisor help himself.

Why not determine for yourself the value in **MANAGEMENT INFORMATION** by requesting your personal copy of "Supervisory Growth." Not just a brochure but a value-packed sampling of actual motivating material including:

- 50 page Pocket Planning Guide
- Skill in Taking Initiative
- 100 Ways to Cut Waste
- Motivation
- Case Studies

WRITE for your personal copy today!

Elliott Service Company, Inc.
Dept. W-1
Mount Vernon, N. Y.

Please provide me, without obligation, with a copy of "Supervisory Growth."

Name .....

Firm .....

Address .....

City .....Zone.... State

128 CIRCLE 128 ON READER SERVICE CARD

Continuous Crushers Solve Ash Plug-Up

Installation of a series of eight single-roll crushers in the ash return hoppers at Hickling Station of New York State Electric & Gas Corp has put an end to a troublesome and time-consuming maintenance problem. Prior to the use of continuous crushing it was necessary to disassemble piping daily and blow out and rod the piping to remove plugged-up ash.

When Hickling Station converted from the burning of No. 4 Buckwheat anthracite to bituminous coal, trouble began due to large pieces of ash plugging up the return system. The use of the fuel with a lower ash-fusion temperature resulted in slag build-up in the superheater. Soot blowers dislodged this material, causing it to fall into a cinder-return hopper. This resulted in large ash plugs in the first-pass boiler hopper, which had to be reduced.

A continuous crusher was placed in test service early last year. It so proved its value in reducing maintenance time that seven additional crushers were put into operation. A line of four single-roll crushers was installed for each of two main units in the station. The crushers turn at 75 rpm and operate 24 hr a day at 400 F. The crushers were supplied by Sprout, Waldron & Co, Inc.

SINGLE-ROLL CRUSHERS running continuously stopped a daily maintenance problem due to plugging of ash in the first-pass hopper

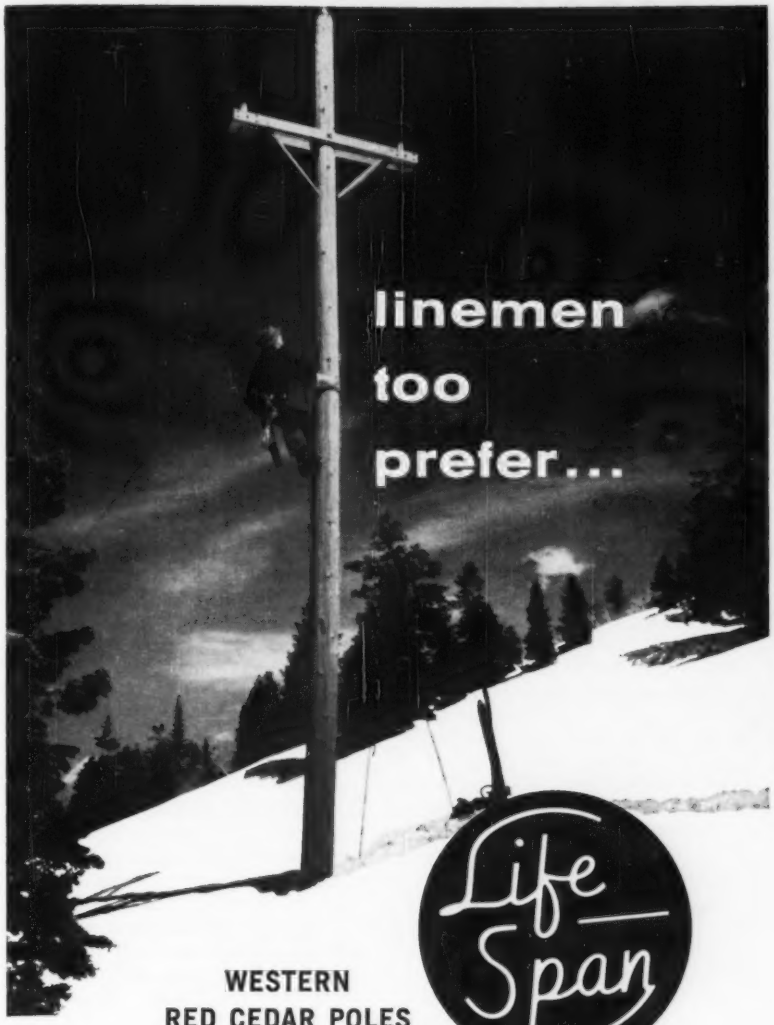
CIRCLE 55 ON READER SERVICE CARD

Handle Cooling Tower Fans with Bridle Sling

BRIDLE SLING simplifies the job of handling cooling tower fans

Lifting of cooling tower fans for maintenance or repair at Kansas Gas & Electric Co's Neosho steam plant has been greatly simplified by the use of a chain-bridle type of sling. The sling was developed by journeyman mechanic Nick Buento. It replaces the cable slings which were used in the past for this job.

The chain-bridle sling is inexpensive, its use saves considerable time in handling the large and unwieldy fans, and it makes the job easier. Job safety has also been improved by use of the new sling.



WESTERN RED CEDAR POLES

They're Safe, Clean to Climb and Deliver Many Added Years of Trouble-free Service

LIFE-SPAN Western Red Cedar Poles are clean and protected from top-to-butt. They are the result of years of continuous research and are **completely** immune to decay. To serve the utility industry better, Page & Hill maintains three mechanized yards with modern handling equipment. The LIFE-SPAN treatment applied to P&H poles complies with all approved E.E.I. or A.W.P.A. non-pressure specifications.

When you buy — specify LIFE-SPAN Western Red Cedar Poles! They're your assurance of longer pole-line service at far less per annum cost.

PAGE & HILL, Inc.
MINNEAPOLIS 3, MINNESOTA

CIRCLE 154 ON READER SERVICE CARD

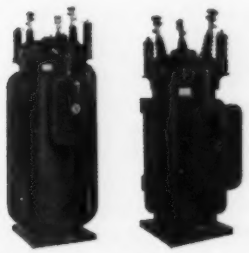
YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

CONVENIENT

WESTINGHOUSE 1¼%-STEP REGULATORS

In addition to dependable operation, convenience and versatility are reasons that make regulators more valuable to you. With pad- or platform-mounted URF units, for example, Westinghouse supplies a hand crank for manual operation of the tap changer. Positions may be changed with the regulator de-energized or motor circuit inoperative.

For data on this and many other exclusive convenience features of Westinghouse regulators, get in touch with your Westinghouse representative. J-70923



Westinghouse URF and URL single-phase feeder voltage regulators

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CIRCLE 129 ON READER SERVICE CARD

MANUFACTURERS LITERATURE

To request literature, use code numbers indicated for each item when filling in Reader Service Card

BREAKERS

LOW-VOLTAGE BREAKERS . . . individually enclosed, 600-v ac, 250-v dc, 225 to 4,000-amp frame sizes, "Urelite" breakers for service-entrance and single-circuit control. Up to 150,000 amp interrupting, drawout construction, quick-make, quick-break operation. Bulletin 4261-2B, 8 pages. I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa. (31)

CIRCUIT BREAKERS . . . safety switches, fusible service and meter mounting equipment, complete "MP" expanded line of plug-in load centers described. Line now includes main lug devices up to 42 circuits, 3-phase panels, double main split bus and 200-amp devices. Catalog, 68 pages. Murray Mfg. Corp, 1250 Atlantic Ave, Brooklyn 16, N. Y. (32)

CONTROLS

VALVE MOTORS . . . Model B Actionator motor with Honeywell yoke assemblies to operate a wide range of slip-stem valves. With integral strain release. Tables and drawings. Folder, 8 pages, Specification S1016-2. Minneapolis-Honeywell Regulator Co, Wayne & Windrim Avenues, Philadelphia 44, Pa. (33)

FEED WATER CONTROLS . . . two-element and single-element air-operated and single-element self-operated. Simplified chart included for selection of proper system. Bulletin 531, 4 pages. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio. (34)

DISTRIBUTION

SCREW ANCHORS . . . new line of power-installed anchors, with installation described in step-by-step photos. Tables on installation time, torque and holding power test data. Bulletin 868, 10 pages. A. B. Chance Co, 210 N Allen St, Centralia, Mo. (35)

CONDUCTOR STRINGING BLOCKS . . . custom engineered. Utility snatch blocks, pole-mounted bracket, aerial cable blocks and larger sizes. Special section on permanently bonded type GNA neoprene sheave lining, now made available in all conductor stringing blocks. Catalog 591, 16 pages. Sherman & Reilly, Inc, First & Broad Sts, Chattanooga 2, Tenn. (36)

POWER FACTOR CAPACITORS . . . substation and pole-mounted, available in 25 and 50 kvar, 24 through 79.6 kv to meet national standards. Factory-assembled for single-row or multi-row configuration or for stacking racks. Bulletin 32B9421, 8 pages. Allis-Chalmers Mfg Co, Milwaukee 1, Wis. (37)

LINE SAFETY EQUIPMENT . . . nine kinds of linemen's belts plus other equipment are included in description of safety equipment, illustrated and described. 1959 Industrial Catalogue, 20 pages. Atlas Safety Equipment Co, Inc, 179 N 10th St, Brooklyn 11, N. Y. (38)

SECONDARY UNIT SUBSTATIONS . . . articulated and integrated, indoor and outdoor. Descriptions, definitions, and general application data, with all major components illustrated and described in detail. Booklet PSG 559, 44 pages. Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa. (39)

VOLTAGE REGULATION . . . handy method of calculating a power system's increase in revenue through regulation of feeder voltage. Formula for finding the annual revenue increase in dollars for a feeder of any size, load factor and percent of voltage-sensitive load when voltage is raised from any lower, unregulated value to 100% of system rating. Graph permits quick calculation of annual revenue increase for voltage improvements of 10% or less. Leaflet GET-3023, 4 pages. General Electric Co, Section GET-3023, Schenectady 5, N. Y. (40)

INSTRUMENTS

LOW-VOLTAGE CT . . .Type TCA, dry type, 200/5 amp or 400/5. Suitable for use with watt-hr meters. Folder, 4 pages, Landis & Gyr, Inc, 45 W 45 St, NYC 36. (41)

PANEL INSTRUMENTS . . . ac and dc meters, elapsed time meters, shunts and current transfromers. Photographs, dimension drawings, tables of ratings, and complete detail on each. Construction of ac and dc meters outlined, also a section explaining how to select panel instruments. Bulletin 3-15, 24 pages. Federal Pacific Electric Co, Fifty Avenue L, Inc, Newark 1, N. J. (42)

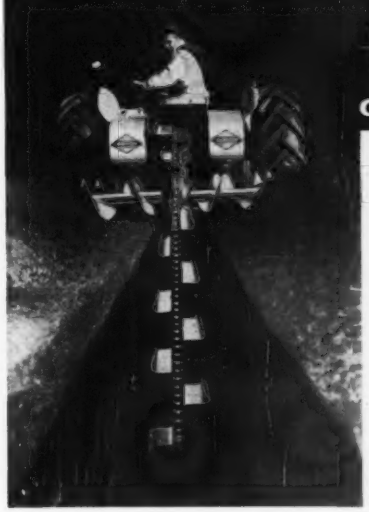
THERMOCOUPLES . . . standard assemblies in protecting tubes and wells for general applications; specialized thermocouples and assemblies for laboratory and industrial applications described. Also replacement elements and bare and insulated thermocouple wires; recommendations on choice and use of thermocouples, components and accessories. Illustrated Catalog EN-S2, 50 pages. Leeds & Northrup Co, 4934 Stanton Ave, Philadelphia 44, Pa. (43)

INSTRUMENT TRANSFORMERS . . . redesigned line of instrument transformers for use with watthour meters. Also types designed for use in swtichgear. All units conform with EEI, ASA, and NEMA standards. Catalog S-503. Standard Transformer Co, Dana Ave, Warren, O. (44)

INSULATION

POLYETHYLENE . . . for molding and extrusion applications is covered by new ASTM tentative specifications, which also are for Bakelite polyethylene resins and compounds for wire and cable applications meeting the specification. Issue No. 109, Kabelitems, 6 pages. Union Carbide Plastics Co, 30 E 42nd St, New York 17, N. Y. (45)

HOW DO AUBURN TRENCHERS CUT THE PRICE of a GOOD DITCH?



- Low Initial Cost
- Less Maintenance
- Less Downtime
- One-man Operation
- Speed on the Job

When you see how the **Auburn** digs in soil conditions that no other trencher can, operates up to 800 feet per hour, and automatically adjusts speed to changing soil conditions, you'll understand why so many dollar-wise users buy **Auburn**. It has a simple, trouble-free design that has been proven through years of service.

Trenches 6 to 14 inches wide and down to 6 feet. Special bits are available for rock, shale, and frozen ground.

WE TRENCH THE EARTH

Auburn is the world's largest producers of trenchers.

AUBURN GEAR-DRAULIC

Tractor-mounted trenchers are available for M-F Work Bulls, IH Utility, John Deere Crawler and Wheel Industrial, and Ford Tractors.

Jeep A-Trench GEAR-DRAULIC

the original Jeep-mounted trencher, and only trencher approved by Willys Motors. Available at Jeep Dealers.

WRITE FOR COMPLETE INFORMATION and Dealer's Name 2040 South "J" Street

AUBURN MACHINE WORKS, INC. AUBURN, NEBRASKA, U.S.A.

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You'll save a lot of time with . .

F & H Self-Powered HOLE DIGGER

★ The modern way to dig holes. No expensive installation. Fits on any A frame. Equipped to dig holes 8' deep and up to 20" in diameter. One man operates digger as all controls are mounted on machine. Available in 9-HP and 18-HP models. Auger is cleaned by spinning. Digs anchor holes with ease. Write for full information. Film of machine in operation available on request.

Manufactured by **FOUSHEE & HECKENDORN**

***Telephone:* BRoadway 4-3745 • CEDAR POINT, KANSAS**

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

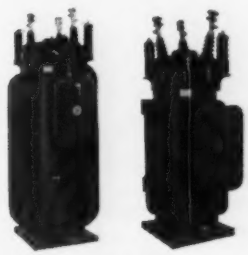
GREATER CAPABILITY

WESTINGHOUSE 1¼%-STEP REGULATORS

Here is a simple . . . and exclusive . . . design feature that makes a great deal of difference in the year-in and year-out performance of a regulator. The tap changer in Westinghouse regulators is isolated from the coils. Carbon formed during arcing is retained in the separate tap changer compartment. Result? Coils are kept clean . . . they operate cooler and retain higher load-carrying ability.

This is just one reason why a Westinghouse regulator can lead a longer and more useful life on your distribution line. For more facts, call your Westinghouse representative.

J-70924



Westinghouse URF and URL single-phase feeder voltage regulators

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CIRCLE 156 ON READER SERVICE CARD

CIRCLE 131 ON READER SERVICE CARD

Trailer Provides Emergency Service

B. F. **GLUNT**, Foreman, Materials Division, Cincinnati Gas & Electric Co, Cincinnati, Ohio

Emergency power is provided with a 25-kva 120/240-v transformer carried in a safe, compact, and low-cost trailer designed and built by Cincinnati Gas & Electric Co. Compared with previous emergency units, the new trailer is lighter in weight —less than 1,000 lb, may be handled easily by one man, and provides a convenient storage cage for primary and secondary leads.

The unit consists of a standard "boat" trailer, including axle, wheels, fenders, and spring suspension. It has a tongue of square tubular steel and a third wheel of the adjustable jack type. This wheel may be locked in place while the unit is in service. Braking is applied mechanically to one of the trailer wheels.

25-Kva Transformer Used

Power is supplied by a self-protected 25-kva transformer mounted inside a circular sheet steel body. Expanded metal screens on top and bottom allow for ventilation and protect against contact with the transformer. A short hot stick, carried inside the screen, is used to energize the secondary breaker through a small hole in the top screen. Secondary neutral of the transformer is connected to the body and chassis, obviating external grounding of the trailer.

Primary and secondary leads are carried in a metal basket around the top of the trailer body and may be uncoiled for use or coiled easily. Flexible conduit on one end of both leads protects against contact.

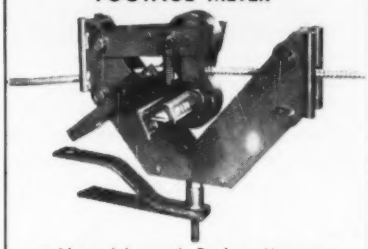
Lights on the body are energized from the secondary when the transformer is in service. Running and stop lights on the trailer are energized from the vehicle that pulls it.

(More Safety on page 133)

REEL-O-MATIC

MEASURE, CUT AND REWIND your own wire and cable

FOOTAGE METER



• New Advanced Design Measures Wire from ⅛" to 1¾" O.D.

REWIND MACHINE

• Hydraulic Jack permits safe, easy lifting of reel.
½, ¾, 1, 1½ & 5-h.p. drives.

• Both Coiling & Reeling with only one rewinding machine.

ALSO AVAILABLE:
- Variable Speed 10-70 RPM
- Collapsible Coiling Reel
- Shaftless Rewind Machine

Write to:
COLUMBIA PRODUCTS, INC.
WRIGHTSVILLE 4, PENNSYLVANIA

CIRCLE 157 ON READER SERVICE CARD

Set Poles in Energized Lines

Hazards of setting poles in energized lines have been reduced for crews of San Antonio Public Service Board through developments of a pole guard. The guard consists of two wooden yokes curved on one side to fit the pole and with leather straps attached to buckle them to the pole. On the other side there is a 2x2-in. notch. A 2-in.x2-in.x6-ft guard pole is fitted to the 2-in. slots in the yokes and secured to the yokes with a wooden dowel pin.

Two Studs Ease Grounding of Vehicles

For improved grounding and added safety to crews when vehicles work with booms in the vicinity of energized lines, Kansas Gas & Electric Co has installed two grounding studs on the frame of each truck, crane or digger. Grounding studs may be installed on a bumper, although the location is at the discretion of the foreman using the vehicle.

Grounding of trucks is mandatory on the KG&E system whenever crews are working with A-frames, cranes or diggers near energized lines. Each vehicle carries a ground tail and a screw-type ground rod. The ground tail has a hot-tap clamp on each end. One is connected to the grounding stud on the vehicle, the other to the ground rod.

When grounding studs are installed on front bumpers the

(*Continued on page* 134)

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

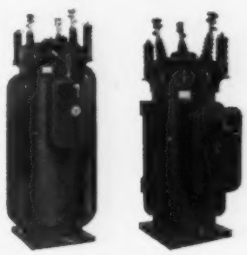
DURABLE

WESTINGHOUSE 1¼%-STEP REGULATORS

The larger steps . . . 1¼% steps . . . of the Westinghouse regulator actually lengthen its life and cut overall maintenance. Larger steps reduce the number of operations. This, together with optimum contact speed, reduces tap changer contact burning. Burning is spread over 20 or more stationary contacts . . . *actually more contacts than other regulator designs with a greater number of steps.*

This is only one of the many ways Westinghouse regulators are more durable than any other you can buy. For more information, call your Westinghouse representative.

J-70925



Westinghouse URF and URL single-phase feeder voltage regulators

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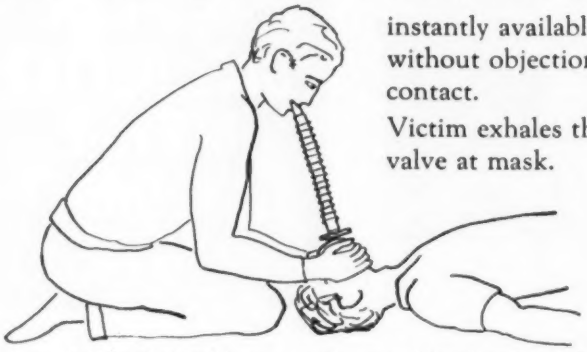
CIRCLE 133 ON READER SERVICE CARD

Breath-of-Life Resuscitation



instantly available without objectionable contact.

Victim exhales through valve at mask.

Every line truck should carry an **Emerson Mouth-to-Mask Resuscitator** with accessories and carrying bag $33

J. H. EMERSON CO.
CAMBRIDGE 40, MASS.

Emerson M-M Resuscitator
Send full information to:

NAME .....

ADDRESS .....

CITY ..... STATE .....

CIRCLE 158 ON READER SERVICE CARD

It took 29 yrs. research to make

JAQUES hydraulic HOLE DIGGERS
Fastest, Strongest, Safest most economical!

Jaques TJ-254 digging at 30 degree angle
Operates at up to 45 degrees

Time-and-money-saving features of Jaques All-Hydraulic Hole Diggers took 29 years to develop. Rugged, versatile Jaques TJ-254 mounts on standard trucks, drills holes up to 48" diameter, to 25' depth, in hardest soil or rock — FASTER, CHEAPER, EASIER than competitive machines! Fewer moving parts insures *minimum down-time, maintenance, operating costs.* Shock-resistant device relieves strain in rock digging. Simple to operate with only 3 primary adjustments. FREE DEMONSTRATION WILL PROVE THESE CLAIMS!!

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☐ Send me FREE detailed literature.
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CITY .....
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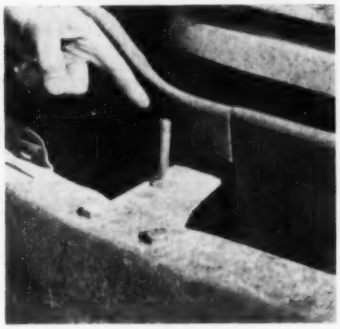
TEXOMA ENTERPRISES, INC.
HIGHWAY 75 NORTH • SHERMAN, TEXAS

Grounding Stud

(*Continued from page* 133)



ground tail is coiled around the studs when not in use. This provides a convenient way of carrying the ground tail and makes it readily available when needed.

Dryer Helps Test Rubber Gloves

***R. L. DuCOTY**, Meter Supervisor, Akron Division, Ohio Edison Co, Akron, Ohio*

A rubber-glove dryer built in the shop is an important part of Ohio Edison Co's rubber goods testing procedure. A squirrel-cage type blower delivers air through an electric heating element in the feeder duct to a table-mounted header.

Using ¾-in. EMT and standard EMT fittings, 30 hanger tubes were mounted on the top panel of the header. Warm air is forced through the hanger tubes to the inside surface of the gloves.

Vinyl Containers Carry Hot Sticks Safely

Rigid Geon vinyl containers for hot sticks have practically eliminated the need for maintenance or refinishing and help keep the hot sticks in excellent condition for long periods. Use of the plastic containers was devised by J. C. Griffin, Superintendent of Florida Keys Electric Cooperative Association, and the local representative of B. F. Goodrich Chemical Co.

Wood hot sticks had always been transported in steel tubes fastened atop trucks. It was found that the abrasive contact between the hot sticks and the container during removal and replacement marred the surfaces of the sticks, requiring refinishing. The hot sticks also picked up bits of rust and flaked galvanizing, making them potential conductors.

This problem was solved by replacing the steel tubes with lengths of 4-in. diameter rigid vinyl pipe. The pipe was fitted with end covers for all-weather protection, and mounted atop the trucks. The rigid vinyl pipe, made from a Geon vinyl compound supplied by B. F. Goodrich, is an excellent nonconductor, cannot rust or flake off, and has no abrasive property on contact with the hot sticks.

PLASTIC CONTAINERS of rigid vinyl do not mar surface of hot sticks as they are removed or replaced

CIRCLE 56 ON READER SERVICE CARD

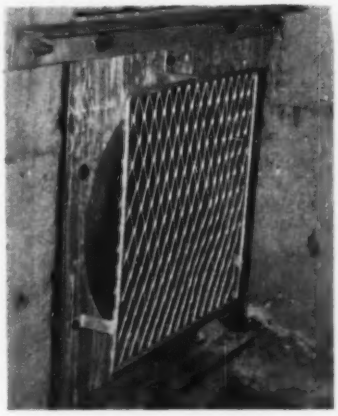
Guard Protects Workmen in Vault

*J. W. **MURRAY JR**, Distribution Engineer, Southwestern Electric Power Co, Shreveport, Louisiana*

Safety of personnel dictated the use of guards on fans providing positive ventilation for vaults of Southwestern Electric Power Co. Fan guards were not installed initially because of the possibility that accumulation of trash on the guards would decrease ventilation.

However, personnel safety outweighed this possibility and guards of 1½-in. No. 16 standard galvanized expanded metal were installed. The metal is welded to ⅜-in. plain rod, to which is welded three brackets for wall mounting.

Only authorized personnel work in vaults on Southwestern Electric Power's system. Therefore, the guards are not entirely fool-proof. They are designed to stand away from the fans to permit debris to fall clear. However, they will prevent a workman in the vault from contacting the fan inadvertantly or from dropping tools into it.



EXPANDED METAL GUARD protects workmen from fans that ventilate transformer vaults. Opening under guard permits easy removal of debris

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

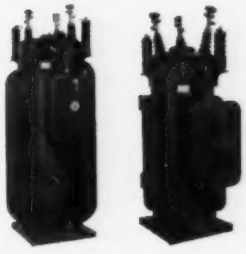
PROTECTED

WESTINGHOUSE 1¼%-STEP REGULATORS

Here is a Westinghouse innovation that provides dual protection, but which is simplicity itself. A single-bolt domed cover permanently seals out moisture and air to prevent acid formation. In addition, this uniquely constructed cover has sufficient flexure to relieve any excessive internal pressures.

Ask your Westinghouse representative about this and the many other features of Westinghouse regulators, the best investment you can make in dependable regulation.

J-70926



Westinghouse URF and URL single-phase feeder voltage regulators

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Westinghouse

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Cut Materials Handling Time 50% in Central Storeroom

Materials handling based on rearrangement of distribution stores and use of a rail-car pickup scheme has cut walking time for filling orders 50-60% for central storeroom personnel. This method was developed by Union Electric Co to expedite the handling of the large volume of material ordered out for distribution crews.

The central storeroom serves 100 line trucks. Orders for each truck are assembled in special material boxes. These are delivered by trailer truck to work centers where they are loaded onto line trucks at night for the next day's work.

The materials pickup scheme is based on the use of a small flat car that runs along rails on a counter. Turned-up edges on the rails keep cars on the track. Materials boxes are placed on the flat car.

Materials are stored in their containers along the counter in the order in which the distribution items appear on the lists from which orders are filled. As items of material for that order are selected and placed in the box, the small rail car is moved along one side of the counter to a point where the next item on the list may be selected.

At the end of the counter, the small rail car is transferred on another rail car to the other side of the counter. This transfer car rides on rails placed at right angles to the counter-top rails. The small rail car then is moved back along the counter as materials on that side of the counter are selected.

When the car reaches the other end of the counter, the box will have all materials required for that line crew's order, with the exception of large items like crossarms and transformers. The box then is removed from the small rail car with a hoist and placed on a pallet.

TRANSFER CAR moves small rail car carrying box of materials from one side of the counter to the other

Cuts the Cost of Tree Trimming

Speeds work, cuts labor cost, and protects workmen against injury. 36" swivel blade tensioned by bent wood bow. Friction reduced by narrow saw blade. Over all length of working section, 5 ft. fitted with ferrule for adding sectional poles extending to any length. We also manufacture insulated tree trimmers, hand saws, tree paint, safety saddles, etc.

rite for Public Utility Catalog 39

Bartlett Manufacturing Co.
3048 E. Grand Blvd.,
Detroit, Mich.

CIRCLE 159 ON READER SERVICE CARD

FOR RUGGED DEPENDABILITY
Specify Grip-Tite
EXPANDING EARTH ANCHORS

Exclusive Grip-Tite *wing* dimples, plus deeply embossed base plate, distributes stress evenly resulting in greater holding power. *Four-Way Design* places a greater portion of expanding area into undisturbed soil and yields more holding power in average soils.

Come To Us With Your Anchoring Problems

Grip-Tite anchors come with *nut retainer*. Prevents anchor from sliding up the rod during installation. Permits salvage, too.

Exclusive double-strength anchor top prevents damage from expanding tool during installation.

DEPENDABILITY AT LOW COST

STEEL EXPANDING **Grip-Tite** ANCHORS

Grip-Tite MANUFACTURING CO.
BOX 111 WINTERSET, IOWA

CIRCLE 160 ON READER SERVICE CARD

Cut Handling Time

(*Continued from page* 136)

It is picked up by a fork-lift truck and loaded onto the trailer truck for delivery to the work center. Three trailer-truck units service the eight work centers each night in St. Louis and the St. Louis County area. At the work center the box is removed with a box dolly directly from the trailer onto a hydraulic lift. The lift is then adjusted to service-aisle height and the box is placed on the proper crew truck for the next day's work. Materials go to the job in the box.

Materials boxes filled with salvage materials are returned by crew trucks to the service centers. From there they go back to the central storeroom via the trailer trucks.

To fill orders for large materials, storeroom personnel use large boxes. The large box is placed on a dolly which runs on rails along the floor. The dolly runs along one set of rails to receive materials and then is transferred to another set of rails to receive materials in the other direction. Large boxes also are taken to and from work centers by the trailer trucks.

The central storeroom and this materials-handling system have many advantages. Much less inventory is required to serve eight work centers. Capital investment in storeroom facilities is reduced. Also, line trucks may be garaged closer to their work.

(*More Stores & Shops on page 138*)

WHY GUESS?.. TELL TRANSFORMER POLARITY... *INSTANTLY!*

DICE POLARITY TESTER

Checks all power and distribution transformers . . . through type and split core current transformers.
Self-contained power supply.
Ruggedly built for field, shop use.

J.W. DICE CO. ENGLEWOOD, N.J.

CIRCLE 161 ON READER SERVICE CARD

No. 1959-AR No. 1958-AR

NEW KLEIN
Replaceable Gaff Adjustable Climbers

These new Klein Replaceable Gaff Climbers assure maximum quality and safety. We recommend leg irons be replaced after three sets of gaffs have been used.

The easily replaceable gaff is held in position by a self-locking screw. Full impact is absorbed by the gaff and leg iron. No load is transmitted to the screw.

Adjustable to 14½, 15, 15½, 16, 16½, 17, 17½, 18, 18½ and 19 inches. Made in matched pairs, right and left. Available with triangular ring at ankle or riveted ankle loop. Aluminum finish. Every climber individually tested.

WRITE FOR BULLETIN 559
Bulletin 559, giving full information on Klein Replaceable Gaff Adjustable Climbers, will be sent on request.

ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York.

Mathias **KLEIN** & Sons
Established 1857 Chicago, U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

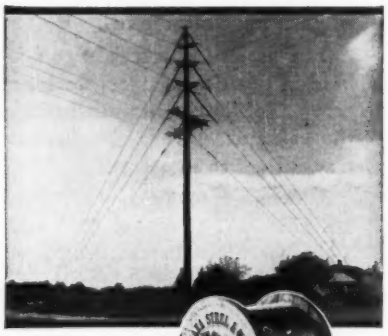
CIRCLE 137 ON READER SERVICE CARD

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.



Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

138 CIRCLE 138 ON READER SERVICE CARD

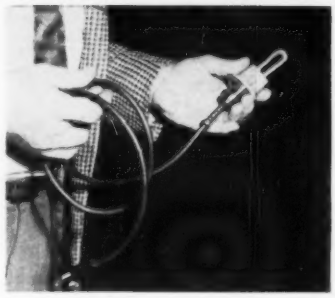
Heaters Ease Starting on Cold Mornings

Easier start-up of trucks on cold mornings follows the use of heater elements at Indianapolis Power & Light Co. The ease in starting eliminates delays of crews getting to the job and greatly reduces the wear on the engines.

Most of the company's trucks are parked outdoors at loading docks at night, giving rise to difficult morning start-ups during cold weather. The problem has been solved by installation of a Calrod heater element in the freeze plug of each truck engine. Heaters are plugged into outlets on the loading dock and operate through the night.

Now there is no trouble in starting the truck engines, even in below-zero weather. Heaters keep the coolant in the radiators and engines warm at night so that engines are warm when crews are ready to go. In addition, line trucks are immediately available for emergency service during the cold weather.

CIRCLE 57 ON READER SERVICE CARD



Modify Standard Fork Lift for Versatility

GEORGE H. IRISH, *Chief, Transportation Branch, TVA, Chattanooga, Tenn.*

Modifications on standard fork lift trucks have enhanced their value to Tennessee Valley Authority. TVA's automotive fleet shops have found that the changes help speed automotive repairs.

On the model shown, the fork has been removed and replaced by a boom with an eye. This permits extending a load over or beyond obstacles. For light loads, a telescopic boom provides even more versatility. One tube is inside the other, and a pin holds them together. For overhead work, as on lights and door actuators, a crow's nest has been made by fitting half a steel drum at the point where the boom is attached. It is both safer and more maneuverable than a ladder.

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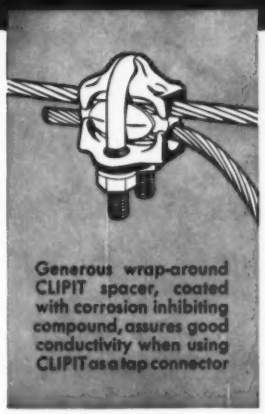

Generous wrap-around CLIPIT spacer, coated with corrosion inhibiting compound, assures good conductivity when using CLIPIT as a tap connector

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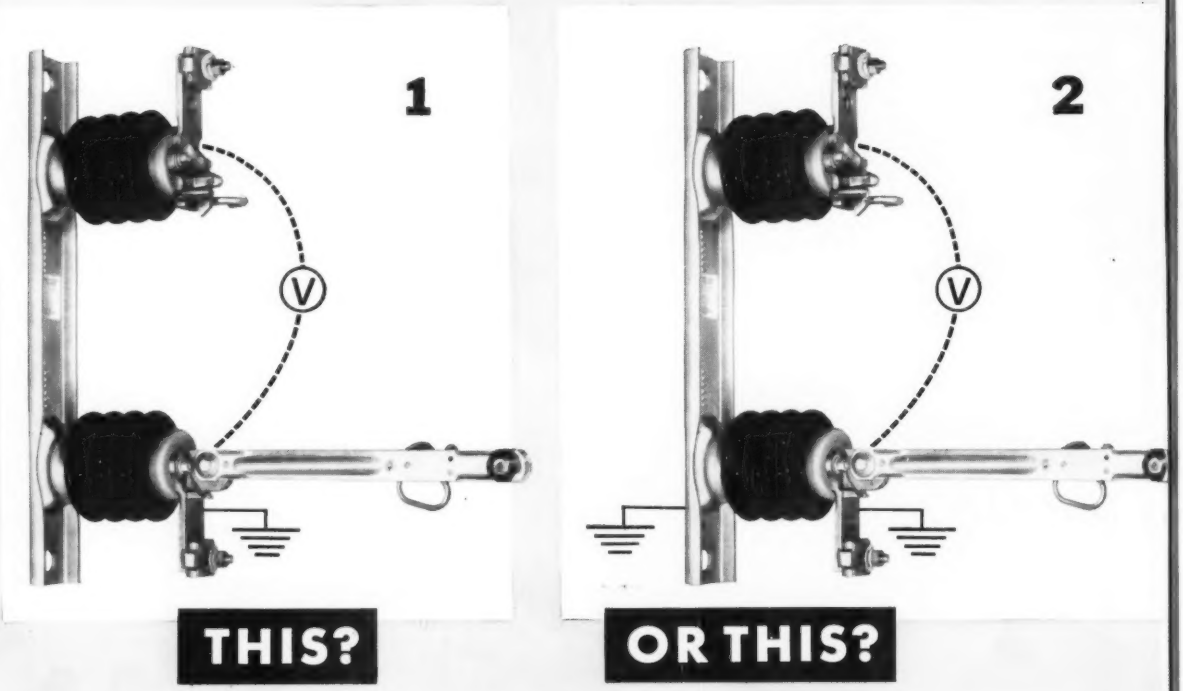
58-13

Q: Which Test Shows a 95 Kv impulse withstand for S&C's 15 Kv LOADBUSTER DISCONNECT?



A: *Both confirm 95 kv for S&C's* LOADBUSTER DISCONNECT.

Test 1 is a less rigorous test. With the base "floating," conventional disconnects can often meet the 95 kv test. But this is an unrealistic condition, for in actual installations the base may be grounded . . . deliberately or not. A disconnect may be mounted on steel, or—even if on a crossarm—wet weather may wash out the "margin."

Test 2 with *base grounded* presents two parallel paths to ground. Under this severe condition S&C's Loadbuster Disconnect meets a full 95 kv impulse withstand.

There are no established AIEE or NEMA standards for this class of disconnect. Nonetheless for lineman safety S&C chooses to meet test 2, another "extra" at no extra cost.

Descriptive Bulletin 721 gives the full story on this remarkable disconnect. Bulletin 721 tells, too, how you can get low-cost load switching anywhere on your distribution system by using this disconnect with LOADBUSTER (the portable loadbreak tool). Write to S&C Electric Company, 4435 Ravenswood Avenue, Chicago 40, Ill.

S&C ELECTRIC COMPANY

Report on
Financing

Faced by a 'mean' money market . . .

Can Utilities Cut Financing Costs?

Utilities are now facing the roughest bond market in almost 30 years. With their total capital expenditures expected to reach $6.9 billion by 1965, the power companies are forced into a market where yields on new issues of funded debt have risen to near-record heights: New Aa-rated utility bonds hover around the 5¼% mark, and an A-rated issue was offered Sept. 18 to yield 5.65%.

Nor is there any good reason to expect money to loosen up in the near future. The Federal Reserve has just raised the discount rate to its highest point since 1930. Government debt, installment credit mortgages, and business borrowing are all running high and seem likely to put an even greater squeeze on the money supply in the months ahead.

What, if anything, can utility financial managements do about it? There are many weapons that might be used to cut money costs, but each company must judge their worth and decide whether they fit. Here is a discussion of a few of them, designed to show their limitations as well as their capabilities.

Can Utilities Save with Shorter Maturities?

The typical utility first mortgage bond matures in thirty years. Normally, however, it has an improvement fund of 1% of the issue operating for the first five years and a 1% sinking fund operating for the remainder of the term. The effect of these funds is to retire 30% of the bonds before the final maturity date, cutting the average maturity of the issue to about 25½ years. Several of the possible methods of reducing present financing costs involve further shortening of the average maturity.

The simplest form of this idea is simply to cut the term of the bonds from 30 years to, say, 25 years or 20 years. With the same improvement and sinking funds, this would reduce average maturity from 25½ years to about 22 years (for a 25-year bond) or about 18 years (for a 20-year bond). The reasoning that

favors such reductions runs like this: Since institutions have sometimes shown themselves to be interested in holding down the average life of their bond portfolios, they might be willing to pay somewhat more for a shorter bond.

But there's another point which seems to favor shorter maturities, even at no substantial saving in yield. This is the near-peak yield basis on which new bond issues currently have to be offered. It is true that no one can predict with any accuracy whether money will cost more or less in 25 years than it will in 30 years. But when interest rates are as high as they are at present, it seems logical to expect yields at any of these future dates to be lower than they are today. Following this assumption, a utility would do well to have any present high-yield issue outstanding for as short a time as possible. What it boils down to is minimizing the redemption premium that the utility must pay to retire the issue before maturity if yields should drop. And the shorter the issue, the smaller the redemption premium would be.

Another way to shorten maturity is to increase the sinking fund. But any benefit obtained in this way would be reduced by the increased cost of financing—through junior securities—the larger payments into the sinking fund. Even assuming that this auxiliary financing was done with debentures (the lowest-cost security which would be available) a yield reduction of at least 0.1% on the original issue would probably be needed before the transaction could be called profitable. Of course, it would be possible to apply these devices in combination, with some outright shortening of the term and some increase in the sinking fund. Also, the improvement fund might be eliminated and the sinking fund started immediately. This might make an issue more attractive, but the chances that it would cut over-all financing costs are slight, since it involves the expense of selling new bonds to replace those retired.

The large life insurance companies provide one pessimistic note. These firms, which buy a rather large percentage of utility bonds sold, seem to be extremely conscious of yield at present. With high yields their target, they might pay no attention to these adjustments. Shorter maturities might, however, make an issue sufficiently attractive to underwriters and their other institutional customers to induce them to accept less yield from a utility issue.

Should Utilities Trade Away the Call Privilege?

Insurance companies have not shown themselves indifferent to one condition in a utility's bonds, and this is a tempting area for financial vp's to consider when faced with the need to cut immediate financing costs. This is the redemption privilege. Several instances in the past few months confirm the fact that an electric utility can get by with considerably lower yields if it is willing to bargain away its right to redeem the bonds at a premium during their first five years of life. Not all companies can consider this, because the Federal Power Commission has ruled against it for utilities under its jurisdiction, and similar policies may be adopted by state commissions.

But even where there is no legal obstacle, this device is one which calls for careful study before it is used. It is sometimes assumed that the maximum loss to a company that tried it would be five years' worth of the difference between the interest on the original issue and the lower interest that could be paid on a later refunding issue—less, of course, the saving in yield on the original issue brought about by waiving the redemption privilege. Although this could be a large sum, it is not the maximum stake a utility is throwing on the table when it trades away the call privilege for five years.

To illustrate this point, let's assume that a company is floating a $10-million issue, and decides to waive its right of redemption for the first five years. After

the issue has been outstanding for a year, interest rates go down by 1%. The loss from inability to refund would amount to about $400,000 over the remaining four-year period, but this might dwindle to $300,000 after chopping off the redemption premium needed to have called in the bonds. From this it would be necessary to deduct the saving on yield on the original issue—perhaps 0.2%, or $100,000—realized by waiving the call privilege. The net loss would thus appear to be some $200,000.

But the loss might not be limited to four years. What if the interest rate went down by a point during the first five years the issue was outstanding, and then went up again? Assuming that yields hit a low, and then went back up to a level 70% as high as the level at which the original issue was sold, then the utility would find the market unfavorable for redemption not just for four years, but perhaps for eight years or even ten years. The loss mounts rapidly for a company so "locked in." If it had to wait nine additional years before it got another chance to refund economically, its net loss would amount to some $520,000. Theoretically, the period of uneconomic redemption could continue throughout the entire life of the bonds, and the loss could be astronomic. Nor is there anything to limit the interest differential to 1%.

Such severe repercussions are not likely, but they are possible. The point is that the redemption privilege is not something to be traded away lightly. Of course, in a special case where it is vital to improve earnings immediately and where the possibility of such losses must be subordinated to the need for quick savings in interest charges, the cure may be worth the calculated risk.

What About Convertibles?

Another way to save on interest charges is to use convertible issues. These take advantage of the desire of many investors to hedge their present fixed-interest holdings which an option to change them sometime in the future into common stock at a level near today's market prices. This is a tricky method of financing. Most of the champions of convertible debentures and preferred's agree that their use should be limited to companies that meet the following prerequisites:

1. **Common stock makes up less than its share of total capitalization.**
2. **Selling common stock now would dilute per-share earnings too much.**
3. **There is an iron-clad reason for expecting earnings to rise** within two years to the point where such dilution will no longer be important, and conversion will be assured.

For a company that fits this pattern, convertibles may be the answer. Proponents say that a fairly valuable conversion privilege should make possible a reduction in yield of at least 0.5% on the new issue, and they point out that such a saving is particularly valuable in a high-yield market such as the present one. They add that, since the expenses on ultimate conversion are negligible, this device will effect a saving of as much as 7% in selling expense under the cost of selling common stock directly.

But this is not a one-sided argument. Other observers of the financial scene offer several objections. First, they say, the utility never has positive assurance that the conversion will take place. Suppose something unforeseen happens to the market, carrying down the price of the company's securities along with the rest? Then the conversion will not come off according to plan, and the upset equity ratio will not be corrected. The company would do better, they say, to issue the common to begin with. At least part of the penalty of dilution will overhang the stock anyway, they add, since the market will know that it is sure

to occur whenever the price gets high enough to encourage the debenture holders to convert.

Another approach they propose would be to issue senior securities now and then to fill the gap in the capitalization ratio as soon as practicable by direct issuance of common stock. They say that these blocks of stock could be sold at better than the market price now available, and better than the conversion price, since no large-scale conversion will occur until the market level is considerably higher than the conversion price.

In fairness to the advocates of convertible issues, it should be pointed out that if the market bogs down in the future, then the company will not be able to sell stock directly without the evils incident to immediate sale. But the opponents of convertibles have another point. They say that the saving of a coupon reduced by 0.5% is less than it appears to be with a convertible issue, since the issue will not be outstanding until maturity, but will instead become common equity in a few years if the conversion is successful.

Why Not Turn to Common?

With first mortgage bond yields close to a 30-year peak and common stock money costing not far from a 30-year low, a "natural" device for saving on financing costs seems to be a switch between the two types of security. Assuming that the financing of a year's expansion involves the sale of enough bonds, preferred, and common to maintain the proper capitalization ratio, the present money markets hint that a company should reduce this year's issuance of bonds and take up the slack with additional common. In two or three years, when bond yields might well be considerably lower, the process could be reversed and the desired capitalization ratio restored.

On a typical $20-million bond issue, such a 1% drop in yield would result in a saving of more than $5 million before taxes. Just what might be gained by such a switch—and just how far such a substitution could be made without unduly diluting per-share earnings—are matters that must be weighed carefully by each company. But the idea holds such intriguing possibilities that it seems well worth considering in the unusual market now faced by utilities.

For that matter, why not just issue more common stock—increasing the ratio? This question may not be so frivolous as it sounds. One immediate reply might be: "Why dilute per-share earnings and reduce market values unnecessarily?" But this come-back assumes that the "quantity" of earnings is the only effective yardstick for pricing electric utility common stocks. Actually, there is another yardstick, recognized by all security analysts as almost equally important, and that is the "quality" of those earnings. This "quality" is hard to put a finger on, but its presence shows up in price/earnings ratios which differ from company to company. So, by "just issuing more common stock," a company could be building up values which might justify a market price higher than the one prevailing before the stock was issued.

This coin also has two sides. Such a program as this one requires careful scrutiny to make sure the company is not paying too much for "quality." In fact, there are a number of cases where a less conservative set-up might work out to a higher value in today's market.

But as long as utility common stock money is so cheap (5.74% in mid-September), the question might be asked, "How can an electric utility go wrong selling common stock at such a level?" In the light of all tradition and financial history, it's hard to find a convincing reply. History and tradition may not be repeated in the future, but they're all we have to tie to. And they both emphatically say: "Sell common stock now."

Greenhouse Owner Likes Electric Heat

C. A. STEELE, Commercial Sales Representative, Kansas Gas & Electric Co, Wichita, Kan.

Better heat control, no fumes, equal distribution of heat, and elimination of plant losses resulting from "hot" and "cold" spots are the reasons why the owner of Lohkamp Nurseries likes electric heat, the newest addition to his greenhouse.

When owner Lohkamp developed plans for additional greenhouse space he planned plastic instead of glass because he knew that a plastic greenhouse could be built almost air tight. Then he installed electric heating because of its advantages over other types of fuel.

Lohkamp was up on electric heating through reading, and radio broadcasts which had informed him of the advantageous electric heating rates in his area.

In the new plastic section of the greenhouse, 9 kw of Chromalox resistance heaters with blower fans were installed. The three heaters were connected by long cables so that they could be placed in various positions in the greenhouse, according to the amount and type of plants there.

Cost of operation of the electric heating has been estimated at $1 per day, but it has been slightly below that figure rather consistently.

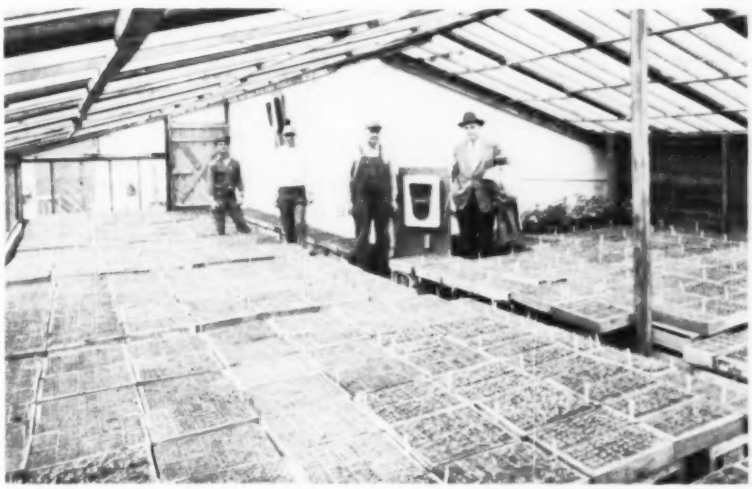
The owner has been so pleased with electric heating that he has already ordered another 8 kw of heating equipment. He plans to replace the gas heating in the other part of his greenhouse with 35 kw of electric heating and will install approximately 45 kw in a new greenhouse to be erected this fall.

He says, "Electric space heating is the finest I could have purchased. I have no regrets. Not only have we had an equal distribution of heat, which we never had before, but we can rely on the every day efficiency of electric heating.

"We have not lost a single plant because of improper heating while using electric heating, whereas before our losses were high."

Plants lost with gas heating, due to fumes and "hot" and "cold" spots, ran from as little as $20 to as high as $500 per year. Lohkamp also states that employees who work in the greenhouses like the fact there is "no smell of gas" and feel comfortable while working.

The Lohkamp Nurseries electric installation has proved so successful that the Agricultural Department of Kansas State University sponsored a meeting there to permit people from all over the state to see the results and how they were obtained.



ELECTRIC HEATING in greenhouse has cut plant losses. Lohkamp (second from right) and author look over flowers grown with aid of electric heat

Westinghouse Introduces New Heating Models

A line of electric heating equipment with completely redesigned wall, floor and bathroom models has been introduced by Westinghouse Electric Corp.

Each of the models has a sloped control panel that is easier to read and operate, Westinghouse says.

Wall models are available in seven sizes from 1,000 to 4,000 w; bathroom models in two sizes, 1,250 or 1,500 w, with or without adjustable control, and floor models in 2,000, 3,000 or 4,000 w sizes.

Wiegand to Hold Heating Workshops

A series of Electric Heating Workshops for utility personnel are to be held by the E. L. Wiegand Co.

The series is as follows:

October 5-6—Commercial Electric Comfort Heating

October 14-15—Electric Process Heating

November 16-17 — Commercial Electric Comfort Heating

November 23-24 — Residential Electric Heating

For additional information write: C. F. Kreiser, Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa.

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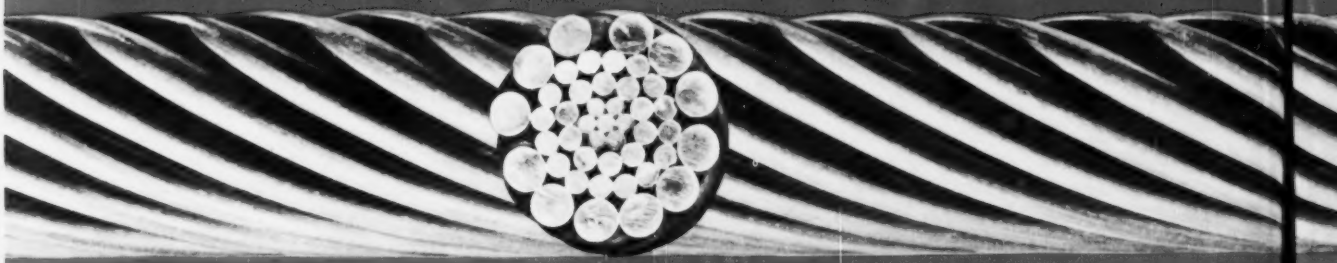

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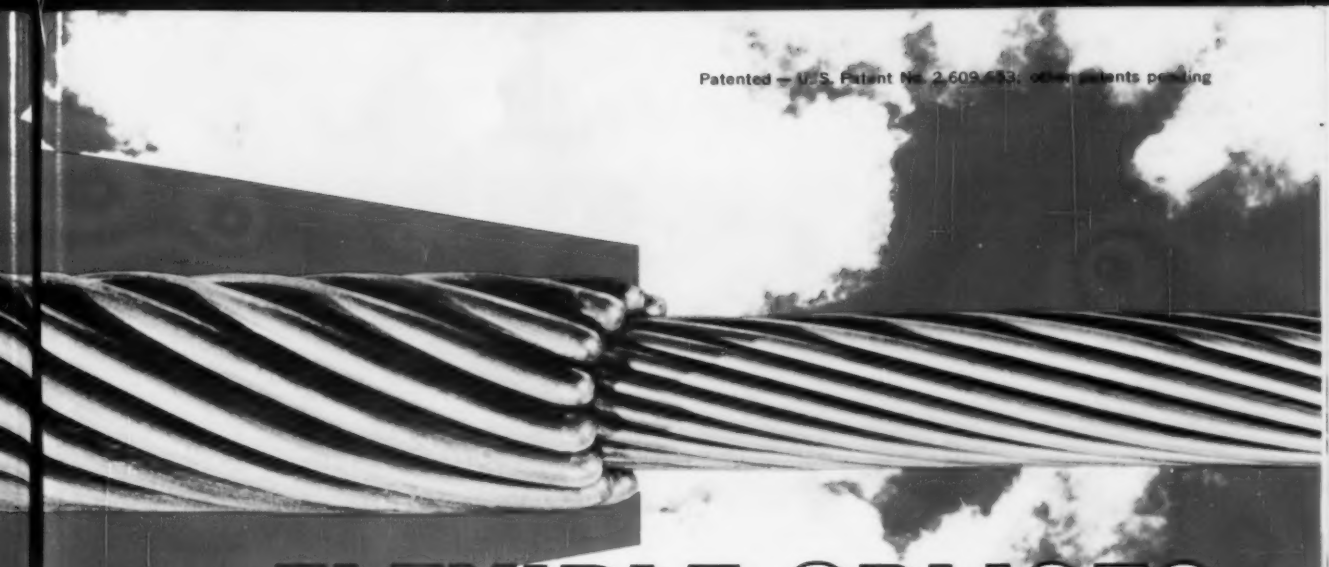

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News About People

GOSS

BORCH

RIEGER

General Electric Promotes Five Executives

General Electric Co has made five major executive appointments, two of which involve organization realignments.

James H. Goss has been appointed vice president and group executive of a new International Group.

Fred J. Borch was named vice president and group executive for the Consumer Products Group, the post formerly held by Goss.

Charles K. Rieger succeeds Borch as vice president-marketing services.

William P. Von Behren has been appointed general manager of the Major Appliance Division, succeeding Rieger, while Hershner Cross has been made general manager of the newly established Radio and Television Division.

Goss has been with GE since 1931. Among his posts were general manager of the Home Laundry Dept and president—Canadian General Electric Co Ltd. Borch joined the company in 1931 and spent 23 years in marketing and administrative work before being named a vice president. Rieger has been with GE since 1936, mostly in the appliance end, and has been a vice president since 1953.

PERSONAL BRIEFS

Allen S. King, president of Northern States Power Co has been named general chairman of the 1960 Minneapolis Farm Forum.

Charles E. Nolan, vice president and promotional manager of Hawaiian Electric Co, will retire December 31. **Francis H. Williams** has been promoted to assistant promotional manager.

A. H. Wade, Jr., assistant to the vice president and general manager, Georgia Power Co has been appointed manager of the company's newly created general services department.

W. G. Wiatt has been named manager of the Spartanburg offices of Duke Power Co replacing **John V. Brookshire** who retires but will remain as a consultant. **Douglas Booth** has been promoted to assistant to **D. W. Jones,** vice president.

Walter L. Maner, Jr., has been named executive assistant at the general office of Virginia Electric & Power Co.

Stone & Webster Engineering Corp has appointed three assistant vice presidents: **Robert S. Boyd,** appraisal manager, **J. Marshall Hamill,** administrative assistant in Boston, and **Wilbur S. Roberts, Jr.,** manager of new business activities in New York.

Mears Electric Cricuit Breakers, Inc, Portland, Ore., named **B. C. West** general sales manager.

William J. Elperin has been appointed manager of the St. Louis office of Clark Controller Co.

Lauchlin M. Currie, vice president in charge of the atomic energy division of Babcock & Wilcox Co has been named chairman of a committee which has been given the responsibility of long range objectives of the Nuclear Congress, policy making decisions and relations with other organizations. Other committee members are: **John R. Dunning,** dean of the School of Engineering, Columbia University; **George E. Holbrook,** vice president, E. I. du Pont de Nemours Co, Inc.; **Wilbur E. Kelley,** president, Associated Nucleonics Inc; and **C. Rogers McCullough,** Monsanto Chemical Co. The Congress will be held in New York, April 3-8, 1960.

T. Edward Rogers has been appointed general sales manager of Philco's Corp's parts and accessory division.

Alcoa Division Names New Vice Presidents

Roger L. Williamson has been named vice president and general sales manager, and Frederick S. Marks, Sr., has been made vice president and manager of distribution of Rome Cable Division of Aluminum Co of America.

Williamson joined Alcoa in 1929 and after sales assignments in various cities became manager of pig and ingot sales in 1955.

Marks first served in various plant administrative posts for Rome Wire Co. and in 1945 was named southeastern sales representative for Rome Cable Corp. He became sales manager in 1951, and treasurer and a director in 1956.

WILLIAMSON

MARKS

McTavish Made Purchasing Agent

James M. McTavish has been made general purchasing agent of Commonwealth Services Inc. He will be responsible for purchasing, expediting, inspection and services.

He was formerly division purchasing agent for Sylvania Electric Products Inc., Atomic Energy Division. From 1944 to 1952 he was supervisor of buyers at Ebasco Services Inc. and from 1931 to 1944 was associated with the Safe Harbor Water Power Corp.

Okonite Co has made several appointments within its marketing division: **C. D. Ham** has been named manager-plans, programs, and special products; **Herbert N. Bush,** factory sales manager of rubber, plastic, and varnished cambric cable products; and **Ray J. Wynne,** manager-tape department.

Bailey Meter Co has named **K. R. Dodson** resident engineer in Corpus Christi, Texas.

General Electric Co has made the following promotions: **W. Blake Miller** to manager of heaters and devices product section in the industrial heating department; **Ralph A. Huwe,** manager-technical and engineering administration, ballast department; **Dr. H. R. Schmidt,** manager-chemical laboratory at the Knolls Atomic Power Laboratory; **Richard H. Graham,** consultant-product planning, atomic power equipment department; **David A. Yates,** manager of sales planning, industrial commercial section, apparatus sales division; **A. M. Swasey,** project leader for the newly created aviation and defense business unit; **Richard W. Morefield,** Houston district manager, assemblies and component sales; **Robert R. Bracchi,** manager, Louisville apparatus service shop; **John T. Hood,** manager of sales planning and promotion for the Pacific Northwest division; **Walter P. Cartun,** general manager of the miniature lamp department; **Arthur H. Huisken, Jr.,** general manager of the industrial paint products section; **Christopher Karabats,** manager of tube construction, Microwave Laboratory; **James E. Pitman,** manager of product planning for point-to-point communication; **F. R. McVicker,** manager-product planning, marketing research, advertising and sales promotion insulator department; **James Hamilton,** manager of manufacturing engineering, general purpose control department; and **James A. Dillon,** construction industries sales engineer for New England.

Alfred Cutler has been appointed manager of international operations, H. K. Porter Company, Inc.

W. Dan Sinclair has joined Kaiser engineers division of Henry J. Kaiser Co as a power consultant. His duties will include development activities in the power field, with emphasis on medium-sized utilities.

Harold Sleeman has been appointed chief engineer of the Porcelain Insulator Corp.

ALMOST HANGS ITSELF

S & C Open Cutouts take the "hit and miss" out of fuse tube handling

It's a cinch to hang the fuse tube in the Type XS open cutout. No fumbling, no missing, no dropping. Think how much easier and safer it makes the lineman's job, especially at night or during adverse weather. The operator's eye view at left shows why linemen like this cutout. There's nothing intricate about the hinge and how to approach it. Notice the wide and deep trunnion pockets in the ears of the hinge. The trunnions on the fuse tube drop in readily, without precise "steering."

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Easy fuse tube installation is just one of many big advantages of S&C XS Open Cutouts. Here are more: 1) exhaust always goes down and away from operator and conductors because of single venting; 2) arc energy and exhaust violence are minimized by an "arc-shortening" device; 3) you get versatile, economical load switching with Loadbuster® (the portable loadbreak tool).

To get an idea of how the XS open cutout can give you system-wide protection and switching, please write S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Illinois . . . and ask for Bulletin No. 511 "S&C Open Cutouts—Type XS."

S&C ELECTRIC COMPANY

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WHO HAS TO KNOW . . .

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W. E. Dugdale, Purchasing Agent, tells why . . .

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George K. Kallenbach, Operating Superintendent, tells why

RESEARCH paid a dividend for Niagara Mohawk's investment in General Electric voltage regulators. G-E system research used network analyzers to determine the optimum regulator arrangement to solve a unique problem.

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3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—333 KVA W-H 67000/69000—240x480
3—333 KVA G-E 66000—2400/4160Y
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2—Lincoln watt demand Graphic Meter, Type CCW, 120 volt, 5A, 60 cycle, 3P3W, unused .....$35.00 each

1—Power Factor Recording Meter, Portable, .6 lag to .6 lead, 115/230 volt, 5A, 3P3W Model 8CD13ECA10 used but in good condition.....$127.50

1—Frequency Recording Meter Flush Switchboard, 55-65 cycle, less external impedor, Type CD27, G.E. 120 volt, Model 8CD27FAA13, Serial #3278332. $65.00

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3—1000 kva Westinghouse, 1/22900/480
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The Meetings Calendar

OCTOBER

• **Interstate Power Club**—Hotel Martinique, New York City, Oct. 5.

• **Edison Electric Institute**—Electrical System & Equipment Committee, Hotel Muehlbach, Kansas City, Mo., Oct. 5-6; Prime Movers Committee, Barringer Hotel, Charlotte, N. C., Oct. 12-14; Area Development Committee, Westward Ho Hotel, Phoenix, Ariz., Oct. 20-22; Statistical Committee, The Homestead, Hot Springs, Va., Oct. 22-23.

• **Institute of Radio Engineers**—Fifth National Communications Symposium, Hotel Utica, Utica, N. Y., Oct. 5-7; Canadian Convention, Toronto, Canada, Oct. 7-9; Fifth Annual Electron Devices Meeting, Shoreham Hotel, Washington, D. C., Oct. 29-30.

• **International Association of Electrical Inspectors**—Western Section, Schroeder Hotel, Milwaukee, Wisc., Oct. 5-7; Southern Section, Heidelberg Hotel, Jackson, Miss., Oct. 12-14.

• **National Association of Corrosion Engineers**—Northeast Region Conference, Lord Baltimore Hotel, Baltimore, Md., Oct. 5-8; North Central Region Conference, Cleveland, Ohio, Oct. 20-22.

• **Fifth Conference on Radio Interference Reduction**—Conducted by the Illinois Institute of Technology and the IRE, Museum of Science and Industry, Chicago, Ill., Oct. 6-8.

• **National Electrical Manufacturers Association**—Officers of Codes and Standards Committee, NEMA Office, New York City, Oct. 7.

• **Missouri Valley Electric Association**—Sales, Rural & Home Service Conference, President Hotel, Kansas City, Missouri, Oct. 7-9.

• **Indiana Electric Association**—Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind., Oct. 7-9.

• **Pennsylvania Electric Association**—Structures and Hydraulics Committee, Holiday Motor Hotel, Harrisburg, Pa., Oct. 8-9; Electrical Equipment Committee, Pick-Roosevelt Hotel, Pittsburgh, Pa., Oct. 8-9; System Planning Committee, Galen Hall Hotel, Wernersville, Pa., Oct. 12-13; Prime Movers Committee, General Brodhead Hotel, Beaver Falls, Pa., Oct. 22-23; Relay Committee, Hotel Alexander, Hagerstown, Md., Oct. 29-30.

• **Utility Companies of Iowa Management Conference**—Annual Meeting, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 11-13.

• **American Institute of Electrical Engineers**—Fall General Meeting, Morrison Hotel, Chicago, Ill., Oct. 11-16; Eleventh Annual Machine Tool Conference, Sheraton-Cleveland Hotel, Cleveland, Ohio, Oct. 19-21.

• **American Society for Testing Materials**—Third Pacific Area National Meeting, Sheraton-Palace Hotel, San Francisco, Calif., Oct. 11-16.

• **National Association of Railroad & Utilities Commissioners**—71st Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 12-15.

• **Electrical Association of Philadelphia**—16th Electrical Progress Show, Convention Hall, Philadelphia, Pa., Oct. 13-15.

• **Wisconsin Utilities Association**—Operating & Sales Convention, Schroeder Hotel, Milwaukee, Wis., Oct. 14-16.

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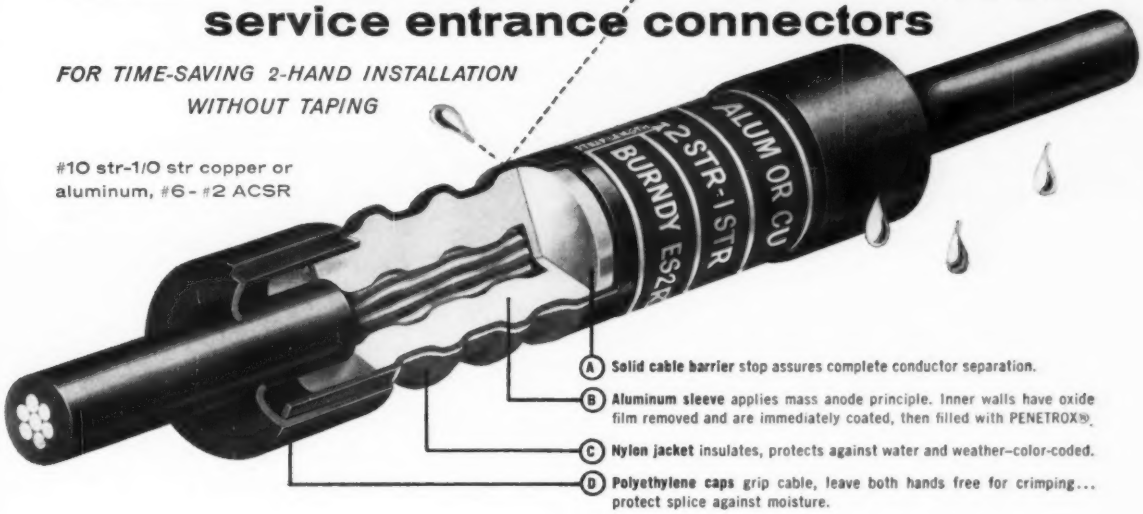

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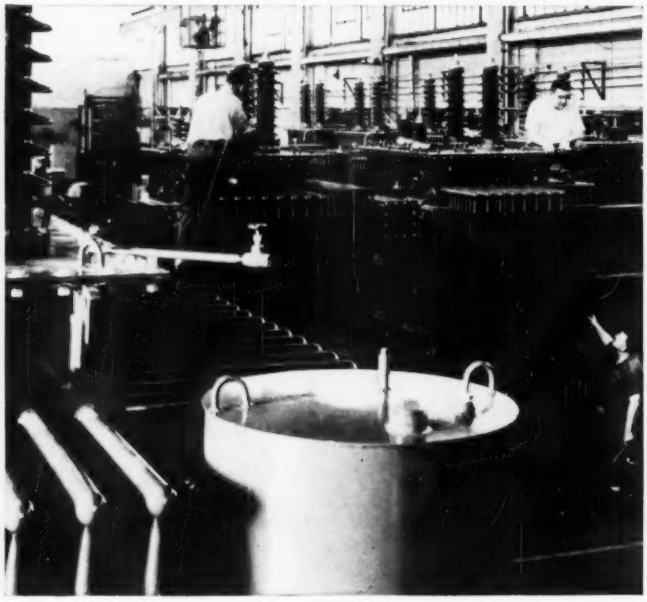

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